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THE 19TH CENTURY

A REVIEW OF PROGRESS

BY

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INTRODUCTORY

TO tell the whole story of the nineteenth century would consume all the time of the twentieth, and the world could not contain the books that should be written. The method of any such enterprise must necessarily be selective, not encyclopædic, and in drawing up a scheme for treatment, the first duty was, obviously, to provide accounts of the political and social developments of countries in nearest touch with our own. To show what new regions of the earth had been brought within our ken was also a necessary part of the task. Then there must be the carrying on of the story of the liberal arts and of literature and education—both as they have prolonged an ancient and honourable tradition, and as they have received and given new light and fresh life. There are also some provinces of knowledge and activity so peculiarly the creation of the nineteenth century that a singular prominence must be assigned them in any review of its lapsing years. Electricity, for example, and photography took their rise within the past hundred years, though whither their mighty and broadening streams will flow in the decades before us the silent Sphinx alone could tell us. Moreover, old paths of human research, such as medicine, have been so made over, so revolutionised and expanded—created anew, in fact—that they seem like an especial trophy of the nineteenth century.

The promise of future achievement, as well, must not be omitted in any survey of the kind. We must make record of the opening doors of opportunity through

which whole races and entire classes are pressing—women, for instance, with their beginnings of enlargement and enfranchisement certain to result in immense social and political changes before the twentieth century shall close.

But when all is said, one cannot mistake the chief characteristic and the crowning glory of the century that is past. We mean, of course, the kindling and quickening of the scientific spirit. As we now say, for convenience, the Age of Homer, the Augustan Age, the *Cinquecento*, the century of Shakespeare and Cervantes, so they will undoubtedly be saying in the twenty-fourth century, the Age of Darwin. It will be because he best typifies the spirit of science which characterises the nineteenth century. By this is not meant the science which simply serves as the handmaid of the useful arts, but that whole conception of life and knowledge which has taken possession of the human mind within the memory of men yet living. The duty of investigation, without which, as Janet said, the world would be an intellectual China; exact methods and the "gospel of verification"; the severe application of the laws of evidence and the laws of thought to every subject; above all, that absolute devotion to veracity which makes a scientist swear by the truth as he is going to understand it, and leads him to regard as his best benefactor the man who corrects his blunders — these are some of the elements of modern science, and the importance assigned it in the distribution of topics is but a reflex of its importance in fact.

It is impossible at this hour of the day to say anything new about the century behind us; and yet the nineteenth century is fortunate in having so many judgments passed upon it in the early days of the twentieth. We remember that we are a part of the thing judged, and we temper our praise, as we shade our blame, accordingly. The situation will be very different eighty years from now.

In 1780, Cowper wrote, "It is to be hoped that the present century has nothing to do with the mouldy opinions of the past." He could say that (though perhaps he did it playfully) because he was so far away from the seventeenth century, and had neither part nor lot in it. But the *siècle* upon which we can at last write *fin* is safe for a score of years at least from hearing any presumptuous mortal speak of its "mouldy opinions." The presumptuous mortal has too good an opinion of his own opinions thus to dub them. Our very nearness to the generation upon which we are sitting in judgment prevents us from either unduly idealising or immoderately despising it. We can assign to it no such happy pre-eminence as Gibbon attributed to the age of the Antonines; for did we not live in it and know that it was not, in fact, a golden age? Yet we cannot denounce it either, as the twelfth and thirteenth centuries have been denounced—though Newman wished them over again, with all their superstition and bigotry.

We who read these lines lived with the nineteenth century, and will confess that it was at least a tolerable companion.

LAW AND GOVERNMENT

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THE IMMUTABILITY OF THE CONSTITUTION

By Charles C. Nott

THE Constitution of the United States is the product of a few great minds assembled in a brief convention. The greatest of modern statesmen has termed it "the most wonderful work ever struck off at a given time by the brain and purpose of man." This characterisation has been accepted by all thinking men. There have been, indeed, cavils at some provisions, and speculative suggestions of alterations and improvements by individual minds; but the universal wonder is that the framers of the Constitution did so well; and that wonder was never so great as now at the close of a stormy century, littered with the wrecks of governments and nations and dynasties and constitutions.

The "given time"! The work was great, the difficulties many — most men then deemed them insuperable — and the work and its difficulties have had commentators and historians for seventy years or more; but will there be a single reader of this article who has noted how short a time it took to frame the Constitution? Has there been a single commentator or historian who has adequately shown how exceedingly brief the "given time" was? Less than a hundred working days measured it.

Moreover, the framers had had no means of previous personal communication by telegraph and almost none by mail; there were no stenographers or typewriters; there was, indeed, no clerical assistance; for the proceed-

ings of the Convention were secret and the clerical work was done by great men. When we see recent conventions with modern facilities for rapid work spending months in putting a few patches on existing State constitutions, we can best appreciate the ability of the men who in eighty-five working days forged the great compact of the people of the United States with themselves — a compact which has lasted more than a century substantially unchanged, which survived the storm of the greatest civil war of the modern world, which has expanded with an unforeseen and unprecedented expansion of inhabited territory from a narrow strip upon the Atlantic seaboard to the shores of the Pacific, and which, notwithstanding changed conditions of life and thought, has grown steadily in the power of moral obligation and become more and more truly the " supreme law " of nearly one hundred millions of people.

As the time was brief, so were the framers few. The Convention was composed of fifty-five members; the Constitution was signed by thirty-nine, including Washington; fifty-one members took part in the debates.(according to the most complete report we have of them, the Journal of Madison), again including Washington. It is generally assumed that he took no part in the debates; but Professor Fiske[1] has said in words which cannot be too often brought before the American citizen:

It was suggested that palliatives and half measures would be far more likely to find favour with the people than any thorough-going reform, when Washington suddenly interposed with a brief but immortal speech, which ought to be blazoned in letters of gold and posted on the wall of every American assembly that shall meet to nominate a candidate or declare a policy or pass a law, so long as the weakness of human nature shall endure. Rising from his President's chair, his tall figure

[1] *The Critical Period of American History*, p. 230.

drawn up to its full height, he exclaimed in tones unwontedly solemn with suppressed emotion: "It is too probable that no plan we propose will be adopted. Perhaps another dreadful conflict is to be sustained. If, to please the people, we offer what we ourselves disapprove, how can we afterward defend our work? Let us raise a standard to which the wise and the honest can repair; the event is in the hand of God."

Some of the fifty-five took no real part in framing the Constitution, and some were obstructionists. Their objections may have exercised a wholesome influence on the Convention, but added much to the cares and perplexities of the greater men who assumed the responsibility and did the work. But whether we take the thirty-nine members who signed the Constitution, or the fifty-one who took part in the debates, or the fifty-five who composed the Convention, the number seems perilously small to be intrusted with the titanic task of founding for all time a great and growing and intensely active nation. Edmund Randolph, speaking of the time when the Articles of Confederation were framed, apologetically called it "the then infancy of the science of constitutions and of confederacies." He might have said the same of the moment at which he was addressing the Convention. Very little did the world then know of the science of constitutions or confederacies! He well summed up the new and added difficulties which confronted the Convention, and which it must meet and overcome:

> The inefficiency of requisitions was unknown [to the framers of the Confederation]—no commercial discord had arisen among any States—no rebellion had appeared, as in Massachusetts—foreign debts had not become urgent—the havoc of paper money had not been foreseen—treaties had not been violated; and perhaps nothing better could be obtained, from the jealousy of the States with regard to their sovereignty.

There were other difficulties which Randolph, like a

tactful statesman, left unnoticed. At one end of the line of financial troubles Rhode Island stood intent on her great scheme of making fiat paper money the equivalent of gold and silver by imprisoning the citizen who charged more for a commodity in the one kind of money than in the other. At the other end of the line stood New York, with the greatest custom-house of the country, her chief source of revenue, which she would be called upon to surrender to the new Federal Government as a part of the price she must pay for coming within the sovereignty of the Constitution. Virginia owned a vast territory which she must cede that it might become the public lands of the United States. Even in the greatness and authority of the men who composed the Convention there were dangers and impediments. Three of the greatest proposed things which would have defeated the great work: Franklin, the wisest member of the Convention, proposed that the legislative power be vested in a single house, which would have been substantially the House of Representatives; Hamilton, the brilliant genius of the Convention, advocated a government of which the President and the Senators should hold office during good behaviour, *i. e.*, for life; Madison, the most sagacious statesman in the Convention, would have cast the responsibility of legislation on the judiciary by lodging a veto power in the Supreme Court. Any one of these provisions would have wrecked the Constitution before it was adopted; and any one of them, if it had been adopted, would have given us a government essentially different from that which we possess.

There is still another extraordinary fact connected with the framing of the Constitution which has received little if any attention, and substantially no comment. In the order of philosophical research the first subject of investigation would be the means or process by which the framers worked. A true philosopher, contemplating the

clearness and conciseness of the Constitution, the masterly handling of the chief elements of the future government, the wonderful adaptation of insufficient means to a glorious end, would instantly exclaim, "Such a work is not born of the human mind completed! What was the secret process by which these great inventors attained their grand result?" And the philosopher would find, as he suspected, that even as the Constitution stands alone in the records of constructive statesmanship, so do the means and methods by which the Convention did its work. It speaks badly for the century that none of the lesser conventions which have convened frequently to experiment with State constitutions has done its work in the same way. In a word, there is nothing which equals the Constitution; there is nothing which approaches the patient, painstaking workmanship of the great Convention.

At the beginning, propositions for consideration and discussion were tentatively placed before the Convention in an *abstract* form. These propositions were embodied in fifteen resolutions, which were immediately referred to the Committee of the Whole. They were taken up one by one, and considered and discussed and amended or rejected or adopted or postponed for later consideration. The abstract of a part of a single day's proceedings will give a clear idea of the way in which the Convention worked:

Tuesday, June 5. Mr. Randolph's *ninth* proposition—*The national judiciary to be chosen by the national legislature*—Disagreed to—*To hold office during good behaviour and to receive a fixed compensation*—Agreed to—*To have jurisdiction over offences at sea, captures, cases of foreigners and citizens of different States, of national revenue, impeachment of national officers, and questions of national peace and harmony*—Postponed.

At the end of two weeks of such consideration and

discussion (June 13th), the Committee of the Whole reported the conclusions which had so far been reached in the form of nineteen resolutions. But everything was still abstract and tentative. No line of the Constitution had yet been written; no provision had yet been agreed upon. The nineteen resolutions in like manner were taken up, one by one, and in like manner considered and discussed and amended or rejected or adopted or postponed. Other propositions coming from other sources were also considered; and so the work went on until the 26th of July, when the conclusions of the Convention were referred to the Committee of Detail, and the work of reducing the abstract to the concrete began. The Convention then adjourned to August 6th, to enable the Committee to "prepare and report the Constitution."

On the 6th of August the Committee of Detail reported and furnished every member with a printed copy of the proposed Constitution. Again the work of consideration began, and went on as before, section by section, line by line. Vexed questions were referred to special committees,—"grand committees" they were called,—amendments were offered, changes were made, the Committee on Detail incorporated new and additional matters in their draught, until, on the 8th of September, the work of construction stopped. But not even then did the labours of the Convention cease. On that day a committee was appointed, "by ballot, to revise the style of, and arrange, the articles which had been agreed to." This committee was afterwards known as the Committee of Style. It reported on the 12th of September, and the work of revision again went on until Saturday, the 15th. On Monday, the 17th, the end was reached, and the members of the Convention signed the Constitution. Well might Franklin exclaim in his farewell words to the Convention: "It astonishes me, sir, to find the system approaching so near to perfection as it does!" He had

been overruled more than once in the Convention; provisions which he had proposed had been rejected; provisions which he had opposed had been retained; but he was a great man and saw that a great work had been accomplished.

This article was to treat of the Constitutional changes of the century. But the extraordinary fact is that from the framers' point of view there has been, with one trivial exception, absolutely no change in the Constitution of the United States. "Are there not fifteen amendments," it will be asked, and " do not the Presidential electors vote for a President and Vice-President in a different way, and is there not an unwritten change in the Constitution by virtue of which the selection of Presidents has passed directly to the people, acting through their political national conventions ? " All these questions may be answered generally in the affirmative; and yet the fact remains that from the framers' point of view there has been, with one trivial exception, absolutely no change in the Constitution of the United States.

The work of the great Convention was the making of a government; and the government which the framers made has remained absolutely unchanged. Madison, who was a wary as well as sagacious statesman, carried the first ten amendments through the first Congress at the first session to assuage public excitement and strengthen the new government and close the mouths of those who railed against it. He introduced into the tenth amendment a rule of construction which would not have been adopted by the Convention, a clause which politically has made much mischief during these one hundred years, but which under the necessities of judicial construction has amounted to nothing, viz., that powers not delegated or prohibited by the Constitution " are reserved to the States respectively or to the people." The other provisions of the ten amendments are little more

than quotations from the Bill of Rights. The Constitution contained but few such declarations: that the writ of habeas corpus shall not be suspended; that no bill of attainder or *ex post facto* law shall be passed; that the trial of all crimes shall be by jury; that such trials shall be in the State where the crime was committed; that no attainder of treason shall work corruption of blood or forfeiture except during the life of the person attainted. The ten amendments declare that Congress shall make no law respecting an establishment of religion or prohibiting the free exercise thereof, or abridge the freedom of speech, or the right of the people peacefully to assemble and petition the Government for a redress of grievances, etc. (Article 1). They provide that no person shall be compelled to be a witness against himself, nor be deprived of life, liberty, or property without due process of law; nor shall private property be taken for public use without just compensation, etc. (Article 5). These are great principles and noble sentiments, but their efficacy depends upon the rectitude of the Government and the vigour and integrity of the people. No Congress would ever have dared to "make a law respecting an establishment of religion," though there had been no Constitutional prohibition; and many an unfortunate citizen has lived and died with his claim for property taken for public use still unpaid, notwithstanding the Constitutional guaranty of "just compensation." In a word, the ten amendments served their temporary purpose; they have doubtless warned off Congress occasionally when in the heedlessness of the short session or in the heat of political excitement a legislative wrong might otherwise have been done; they have in a few instances secured the individual citizen judicially in his natural right to life, liberty, or property; they continue to be a standing moral restraint upon the legislative and executive branches of the Government; and they form a noble

decalogue of great principles to be kept before the eyes of all American citizens; but, nevertheless, the judicial records of the century show that the Government which the framers of the Constitution established would have moved on just as it has done, if these ten amendments had never been proposed. The conscience and intelligence of the country have been the real safeguards of the citizen against injustice and oppression.

The eleventh amendment was caused by the extreme ground taken by the early Supreme Court in *Chisholm vs. Georgia* (2 Dall., R. 419), and the incipient rebellion of that State. Its purpose was to overrule that decision and to exempt a State from suit by a citizen. If Marshall had been upon the bench the decision would never have been made; and, singularly, it was overruled by the same court a hundred years afterward (*Hans vs. Louisiana*, 134 U. S. R. 1). The thirteenth, fourteenth, and fifteenth amendments grew out of the Civil War. They abolished slavery; they impose restraints upon State governments; they confer on some persons Constitutional rights; they guarantee certain rights, privileges, and immunities to citizens and persons; and they contain some provisions relating to representation in Congress. Much litigation has been caused by them; some statutes have been held Constitutional and some unconstitutional; a larger proportion of representation has fallen to the Southern States; the guaranty given to all citizens of the right to vote without regard to " race, colour, or previous condition of servitude " is not absolutely effective, and the Government of the United States moves on precisely as it did before.

It has been said herein that from the point of view of the framers of the Constitution their work has been changed in only one trifling particular. That change relates to the election of President, and was effected by the twelfth amendment. The purpose of the framers

was a wise one: to secure for the country the two strongest statesmen of the party constituted for the time being of the majority of the people, to fill the offices of President and Vice-President. No better plan could have been devised for obtaining a strong Executive. We see a weak and modified application of the principle in national conventions when the defeated "wing of the party" is placated by being allowed to designate the candidate for Vice-President. Under the Constitution as it originally stood each elector voted for two persons for President. He who should have the greatest number of votes would become President; he who might come next would be Vice-President. Under this provision, Mr. Lincoln, in 1861, would have become President, and Mr. Seward Vice-President. That is to say, the Republican electors, following the direction of their party, as expressed by the national convention, would have cast all their votes for Mr. Lincoln, and all but one for Mr. Seward. But in 1801 there had been a tie, whereby the electors had failed to elect, and the election had gone into the House. If it had not been for that mishap, the twelfth amendment would not now exist; and if the original system had survived until the time of rapid communication by railroad and telegraph and better party organisation, it is safe to say that it would now be in unquestioned operation. Political conventions would long ago have adopted its leading principle, and the struggle would have been as to which of the two strongest candidates should be first or second upon the ticket. The system would have given greater dignity to the office of Vice-President, and would have brought the possible importance of that office always before the eyes of the citizen. But whether we think well or ill of the original method, one thing is certain, that the only change made by the twelfth amendment is a trivial one of administrative detail. After all the changes this country has passed

through in the last hundred years—changes in civilisation, of territory, of population, of ideas, education, and public convictions, and individual life—changes such as the world has never witnessed in one country or in one century, the only change made in the Constitution has been the paltry one of having the electoral vote cast in one form instead of in another.

The unwritten amendment of the Constitution, as it has been called, also relates to the selection of the President. It is said by some of the commentators, and indeed it is now generally believed, that the electoral colleges were intended to be " deliberative bodies." In one sense this is true—in the legal sense. The electors are not ministerial or administrative officers; they do not perform a specific work in a way determined by higher official authority; in legal contemplation the responsibility of their action rests upon themselves. But the framers of the Constitution never supposed that the electors would disregard the political pledges upon which they were chosen, or that the American people, either directly or through their State Legislatures, would blindly choose electors to evolve a President out of their inner consciousness. On the contrary, they contemplated the successful candidates receiving the votes of " a majority of the whole number of electors," and they required the electors to vote " in their respective States," and to vote on the same day. If they had framed a provision requiring all of the electors to convene at the seat of the government in one body, and there in their own way and time proceed to choose a President, there would be some reason for saying that actual deliberation was intended; but they did not give to the electors one single power or attribute by virtue of which they could deliberate.

That very thing was attempted and the attempt failed. The question before the Convention was, in effect: " Where shall the deliberative power to choose the

President be vested when the formal casting and counting of the electoral vote fails to elect ?" The answering propositions were, "In the Senate," or "In the House of Representatives." Then Spaight, of North Carolina, said that " he would prefer their [the electors] meeting altogether [all together] and *deciding finally*"; and he moved " *that the electors meet at the seat of the general government* "; and all of the States except North Carolina voted against it. The evidence is therefore both negative and positive—the Convention did not invest the electors with the necessary powers and means for deliberation, and positively refused to do so.

The idea that it was ever intended that the electors should nominate the candidate for whom they themselves should vote is a myth which is generally believed and which has been unthinkingly reiterated by most eminent writers, but which does not rest upon a single fact. There was no one thing which perplexed the Convention more than the subject of the Executive. Plan after plan was weighed and found wanting. The electoral system was late in coming to the front, and was the solvent of many difficulties. Hamilton early foresaw the inevitable, and proposed that " the selection be made by electors chosen by the people." Madison, later, said that the option before the Convention " lay between an appointment by electors chosen by the people and an immediate appointment by the people "; and he at the same time said that " the electors would be chosen *for the occasion*, would meet *at once*, and proceed *immediately* to an appointment." It was as well understood then as it is now that they would but register the decree of the political power which appointed them. The internal evidence of intent is even more conclusive. He who supposes that the framers intended *that thirteen different bodies should convene in thirteen different places at one time for one object and for one day, and that object the selection*

of the Executive of a nation, confesses a most superficial knowledge of the greatest constructive statesmen of their century and of the great work which they deliberately planned and built.

And what better could the framers of the Constitution have done? Wilson, who proposed "an election by the people," was "almost unwilling to declare the mode which he wished to take place, being apprehensive that it might appear chimerical." Gerry, "who liked the principle," "thought the community not yet ripe"; he "was for waiting till the people should feel more the necessity of it." Gouverneur Morris admitted "that difficulties attended this mode," but thought that they would be "found superable." Madison liked an election by the people best, but acknowledged "the disadvantage this would throw on the smaller States." Ellsworth declared "the objection drawn from the different sizes of the States unanswerable."

It has been a fashion of late to speak of the electoral system as curious machinery which may give rise to serious complications; but, viewed amid the difficulties and conditions and limitations of 1787, there is no stroke of practical statesmanship in the Constitution more wise and ingenious. The choosing of candidates soon drifted into Congress; with the coming of the steamboat and the railroad it passed from the Congressional caucus to national conventions; and yet, notwithstanding these radical changes of usage, the expansion of territory, the multiplication of States, and the unscrupulousness of political partisanship, there have been no more mishaps than are incident to any system of human device.

To foretell the future of the Constitution is to foretell the future of the American people. They will change before it is changed. As with Washington and Lincoln, the more we know of them the better they appear; so of the Constitution, the more we contemplate its trials the

better it appears adapted to our national needs. With the growth of knowledge there has been a growth of reverence. The people will experiment with State constitutions and tear them up and experiment again, but when it comes to the Constitution — the great Constitution — there is a sturdy sentiment of "hands off," and that sentiment is incomparably stronger now than it was at the beginning of the century. Judicial construction has moved backward rather than forward, and where Marshall left it it stands, substantially, to-day.

The amendatory provision of the Constitution is an unbarred door which may be opened at any time. It was wise and prudent of the framers to leave it thus unlocked. But he who tries to swing open that door will find two things on which he did not reckon: first, a *vis inertia* in the ignorance and indifference of Congressmen —in their doubts whether the amendments will be popular — in their absorption in lesser things; and, second, that there is always someone on the other side pressing back the door.

At this time there is an amendment pending to have Senators elected directly by the people. It is a popular amendment, and yet is absolutely needless. The men who framed the Constitution constructed it of general principles, and left it flexible for administrative details. Long ago, Abraham Lincoln and Stephen A. Douglas were Senatorial candidates, and were as directly candidates before the people of Illinois as Mr. Gladstone and Lord Beaconsfield ever were before the people of England; and the Legislature of Illinois carried into effect the public will. During the past year the people of North Carolina have nominated a candidate for Senator by what is termed a "direct primary," and the Legislature of North Carolina will give effect to their will. When the people of the United States find that it is easier to instruct the delegates they send to State conventions to

proceed and nominate a candidate for United States Senator than to obtain an amendment to the Constitution, the election of Senators by the people will in practical effect take place.

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PROGRESS OF INTERNATIONAL LAW IN THE CENTURY

By John Bassett Moore

NOTHING could better exemplify the fallacy of drawing from present ills despondent prophecies of evil than a comparison of the state of international law at the close of the nineteenth century with its condition at the beginning. The wars in the midst of which the century opened were not only world-wide in their effects, but they were characterised by a defiant disregard and systematic violation of the rules of international conduct. As early as 1793, both France and Great Britain, soon after the war broke out between them, sought to interrupt the lawful course of neutral trade. With this object each Power adopted measures the injurious effects of which were greatly aggravated by the irregular and arbitrary manner in which they were executed.

The Peace of Amiens proved to be but a brief truce, and after the war was renewed even greater excesses were perpetrated. The idea of conquering England by destroying her trade, though it did not originate with Napoleon, was the inspiration of his so-called continental system. On March 28, 1806, Prussia, after taking possession of Hanover, published, in pursuance of her agreement with Napoleon, a proclamation which purported to close the ports of the North Sea, as well as all rivers running into it, against British ships and trade. The British Government sought to retaliate by an order in council

which declared the mouths of the Ems, the Weser, the Elbe, and the Trave to be in a state of blockade. Napoleon then issued his famous Berlin decree, by which he assumed to blockade the British Isles, and to prohibit all commerce and correspondence with them. Great Britain's response was an order in council not only forbidding neutral vessels to trade between ports in the control of France or her allies, but also forbidding them to trade, without a clearance obtained in a British port, with the ports of France and her allies, or with any port in Europe from which the British flag was excluded. Napoleon's answer was the Milan decree, declaring every vessel that had submitted to search by an English ship, or consented to a voyage to England, or paid any tax to the English Government, and every vessel that should sail to or from a port in Great Britain or her possessions, or in any country occupied by British troops, to be denationalised and to be good prize. By these measures the right of neutrals to hold commercial intercourse with belligerents was virtually denied, each belligerent endeavouring under the guise of blockades, which existed only on paper, to prevent all trade that could not be made subservient to its interests. It is hardly conceivable that any Power would now venture to assert such pretensions. They were at the time scarcely defended on legal grounds; and in the Declaration of Paris of 1856, to which both France and Great Britain are parties, it is expressly recorded that "blockades, in order to be binding, must be effective." This rule is recognised as but the expression of a principle of international law. The illegality of paper blockades is to-day universally acknowledged.

No less important than the subject of neutral rights is that of neutral duties. The first authoritative formulation of the duties resulting from a state of neutrality is to be sought in the executive, legislative, and judicial acts of the United States in 1793 and 1794, during the first

series of European wars growing out of the French Revolution. But upon the foundations then laid there has been built up in the past hundred years an elaborate and well-regulated system, the obligatory character of which is not now questioned. The comprehensive neutrality statute of the United States of April 20, 1818, became in the following year the model of an act of the British Parliament. From time to time laws and regulations were adopted by other governments, and the duties of neutrality became a determinate part of international law. The final vindication of the system as the ultimate standard of international obligation and responsibility was made in the case of the Alabama claims.

In the discussion and practice of neutrality, rules have naturally been formulated as to what constitutes a state of belligerency, and as to the conditions under which it should be recognised. The recognition of belligerency presupposes the existence of a state of war in the international sense, and necessarily implies that the parties to the conflict may exercise towards each other and towards third Powers such rights as war gives. But on or near the border line that divides peace from war there stands pacific blockade, a measure of recent invention, the precise legal position of which has not been authoritatively determined.

During the first half of the nineteenth century a fruitful subject of controversy was that of visitation and search. That belligerent cruisers might lawfully visit and search the merchant vessels of neutrals on the high seas, for the purpose of enforcing the observance of the laws of war, was on all hands admitted; but in certain cases, as in that of the impressment of seamen, the belligerent right of search was sought to be employed for other purposes; and it was even asserted that a right of search existed in time of peace, especially for the purpose of putting an end to the slave trade. These pretensions were

vigorously resisted, especially by the United States. In 1858, the Senate unanimously resolved

that American vessels on the high seas, in time of peace, bearing the American flag, remain under the jurisdiction of the country to which they belong, and therefore any visitation, molestation, or detention of such vessels by force, or by the exhibition of force, on the part of a foreign Power, is in derogation of the sovereignty of the United States.

" After the passage of this resolution," said Mr. Fish, as Secretary of State, " Great Britain formally recognised the principle thus announced, and other maritime Powers and writers on international law all assert it."

It would be difficult to overestimate the importance, both theoretically and practically, of the establishment in the past century of the freedom of vessels on the high seas from visitation and search in time of peace. It was the acknowledgment of this principle that made the seas really free and gave freedom to commerce. Nor does the freedom of the seas become less important with lapse of time. As a principle it grows rather than diminishes in the estimation of mankind; for, in the light of history, its evolution is seen to mark the progress of commerce from a semi-barbarous condition, in which it was exposed to constant violence, to its present state of prosperous security.

Closely related to the principle of the freedom of the seas is the question of the navigation of the narrow channels by which they may be connected. This question has been discussed in respect of natural channels in several cases, the most notable of which was that of the dues charged on vessels and their cargoes passing through the Danish Sound and Belts. By treaties made with the interested Powers in 1857, Denmark relinquished the dues, the Powers paying her once for all a lump sum, in consideration not only of her renunciation of tolls, but also of her agreement to maintain such lights, buoys, and

pilot establishments as the trade of the Baltic might require. An artificial channel necessarily involves special considerations. Its construction requires the expenditure of money and gives rise to proprietary rights; and it is not denied that those rights may be asserted by the exaction of tolls. In this respect the navigation of the artificial channel obviously cannot be free. But, although it cannot be said that the subject has been authoritatively settled as a part of international law, a tendency has been shown in the case of great international highways to act upon analogies and to make the artificial channel free in the sense that it shall be open to the ships and merchandise of all nations on equal terms.

While the right freely to navigate the seas has been established, a great advance has been made towards assuring the free navigation of waters flowing into the sea, in cases in which they wash in their navigable course the territory of two or more states. By the Treaty of Vienna of June 9, 1815, it was agreed that rivers which separated or traversed two or more states should, along their whole navigable course, be, in respect of commerce, entirely free to everyone, subject only to regulations of police. This principle was applied primarily to the Rhine, but was also expressly extended to the Neckar, the Mayne, the Moselle, the Meuse, and the Scheldt. With a limitation of the right of free navigation in some instances to the citizens or subjects of the riparian Powers, similar stipulations may be found in treaties relating to the rivers and canals of the ancient kingdom of Poland; to the Elbe, Po, Pruth, Douro, Danube, and other rivers in Europe; and to the rivers Plate, Paraguay, Uruguay, St. Lawrence, Yukon, Porcupine, and Stikine, in America. By an imperial decree of December 7, 1866, the Government of Brazil opened " to vessels of all nations," after a certain day, the Amazon as far as the frontiers of Brazil; the Tocantins, as far as Cametá; the

Tapajos, as far as Santarem; the Madeira, as far as Borda; the Negro, as far as Manáos; and the San Francisco, as far as the city of Penedo.

The principle of freedom, which has been so widely extended in commerce and in navigation, has also been acknowledged in matters of government. Such an acknowledgment may be seen in the established rule that new states and new governments are entitled to recognition on the ground of their *de facto* existence. The old theory of legitimacy and divine right found its last practical assertion in the acts of the Powers composing the Holy Alliance, who, in their various circulars, associated " revolt and crime," denounced " as equally null, and disallowed by the public law of Europe, any pretended reform effected by revolt and open force," and announced their determination " to repel the maxim of rebellion, in whatever place and under whatever form it might show itself." Their acts corresponded with their words; but they were soon forced by the progress of events to abandon their ground, and to admit in practice the principle which they had condemned.

In the last hundred years there has been witnessed a change in the law relating to the acquisition of territory by occupation. In former times, when so large a part of the world was unsettled, great weight was given to the mere fact of discovery. Under the Papal Bull of 1493, and the Treaty of Tordesillas of the following year, Spain and Portugal sought to divide between themselves on that ground the whole unknown world. Even the early English charters asserted the British title to extend from the Atlantic to the Pacific. In the nineteenth century, and particularly in the latter half of it, the Powers have, especially in respect of territorial claims in Africa, recognised more clearly than was ever done before the necessity of actual and effective occupation as the basis of permanent national title.

In the system of extradition, which is chiefly the development of the nineteenth century, we find one of the many evidences of the growth among nations of a clearer perception of the duty of promoting common social ends. In former times there existed a strong repugnance to the surrender of fugitives from justice. This was due partly to the ancient idea of asylum, partly to perverse notions of national dignity, but perhaps in largest measure to ignorant and groundless prejudices. It was not, indeed, until the middle of the century that the great expansion of the system may be said to have begun. Since that time, however, its growth has been rapid and far-reaching.

An increasing tendency to acknowledge the force and supremacy of law may be seen in the growing frequency of arbitrations for the settlement of disputes between nations, not only as to the rights of individuals, but also as to their own rights, as well as in the recent efforts to establish a permanent system of arbitration, as proposed in the plan of the International American Conference, in the unratified treaty between Great Britain and the United States, and in the convention lately adopted at The Hague. During the nineteenth century there were, exclusive of cases still pending and incomplete, at least 136 international arbitrations. Probably there were more, though certain lists lately circulated, by which the number appears to have been vastly greater, are quite inaccurate, since they include not only numerous cases of mediation, but also ordinary boundary surveys, domestic commissions, and even pure diplomatic negotiations. Both in the number of arbitrations and in the importance of the questions involved in them, the United States and Great Britain easily lead the way.

There are two modes in which international law may be developed. The first is the general and gradual transformation of international opinion and practice; the second is the specific adoption of a rule of action by an act in its

nature legislative. The operation of the former mode it is often difficult to follow in its details, but its effects are potent and undeniable. Perhaps its clearest and most definite exposition may be found in the recent opinion of the Supreme Court of the United States in the case of the Spanish fishing-smacks, the *Paquete Habana* and the *Lola* (the *Paquete Habana*, 175 U. S., 677). The particular point decided was that coast fishing-vessels, with their implements and supplies, cargoes and crews, unarmed and honestly pursuing the peaceful calling of catching and bringing in fresh fish, are exempt from capture as prize of war. In reaching this conclusion, the court considered the question whether the exemption was merely a matter of "comity," or whether it was a matter of legal right to which the court was bound to give effect. In behalf of those who sought the condemnation of the vessels there was cited an opinion of Lord Stowell, in which it was said to be "a rule of comity only, and not of legal decision." With reference to this statement, Mr. Justice Gray, who delivered the opinion of the Supreme Court, said:

> The word "comity" was apparently used by Lord Stowell as synonymous with courtesy or good will. But the period of a hundred years which has since elapsed is amply sufficient to have enabled what originally may have rested in custom or comity, courtesy or concession, to grow, by the general assent of civilised nations, into a settled rule of international law. As well said by Sir James Mackintosh: "In the present century a slow and silent, but very substantial mitigation has taken place in the practice of war; and in proportion as that mitigated practice has received the sanction of time, it is raised from the rank of mere usage and becomes part of the law of nations."

The importance of this judicial declaration, in its bearing on the development of international law, it is difficult

to overestimate. Even the most eminent judges have seemed at times to labour under the impression that it was somehow the peculiar prerogative of a remote age to fix by its customs, however rude and barbarous they may have been, an immutable law in comparison with which the practices of modern times are merely "comity" or "courtesy," which may be discarded at will. The enlightened declaration of the Supreme Court, which was the very foundation of its decision, should have a potent effect in clearing away the misconceptions on which many well-known dicta, of an opposite effect, are founded.

The nineteenth century is, however, specially distinguished for the modification and improvement of international law by what may be called acts of international legislation. Among the sources of international law the publicists commonly enumerate the stipulations of treaties. Where a certain rule of action is uniformly embodied in a succession of treaties between the leading Powers of the world, it assumes in course of time the character of a principle of international law. But in the past century, immediate and important results have been directly produced by means of international conferences.

Allusion has already been made to the effort of the Congress of Vienna to establish the free navigation of international rivers as a general principle. By the same Congress an important contribution to international law was made in the form of rules to regulate the rank and precedence of diplomatic agents. By those alone who are familiar with the annals of diplomacy can the delicacy and interest of this subject be fully appreciated. It had probably given rise to more disputes and caused a greater waste of time than any other within the whole range of international relations. The rules of the Congress of Vienna, slightly modified by the Congress of Aix-la-Chapelle of 1818, were accepted by all the Powers which then composed the international circle. They divide

diplomatic agents into four classes: (1) Ambassadors, legates, and nuncios, who, in a sense, specially represent the person of the sovereign. (2) Envoys, ministers, or other persons accredited to sovereigns. (3) Ministers resident, accredited to sovereigns. (4) Chargés d'affaires, accredited to ministers for foreign affairs.

Yet more remarkable as an act of legislative aspect was the declaration on maritime law made by the Congress of Paris of 1856. The declaration embraced four rules:

(1) Privateering is and remains abolished.

(2) The neutral flag covers an enemy's goods, with the exception of contraband of war.

(3) Neutral goods, with the exception of contraband of war, are not liable to capture under the enemy's flag.

(4) Blockades, in order to be binding, must be effective, that is to say, maintained by a force sufficient really to prevent access to the coast of the enemy.

The fourth rule may, as has heretofore been observed, be considered as merely declaratory of international law; for publicists had ceased to defend the paper blockades of the Napoleonic era. The third rule may also be classed as declaratory, since it was generally observed in the absence of a treaty stipulation to the contrary. But by the first two rules it was proposed to give the character and force of law to principles which had previously been obligatory only where they were made so by express treaty. This element in the situation was acknowledged in the declaration itself, in which the signatories announced their purpose to invite the adhesion of other Powers with a view "to establish a uniform rule." The Powers invited to adhere embraced practically all those within the sphere of international law; and, with the exception of the United States, Spain, and Mexico, they accepted the declaration in its entirety. Those three Powers objected to the naked inhibition of privateering,

but the United States offered to go further and exempt private property at sea altogether from capture, save in the cases of contraband and blockade. All the Powers, however, approved the second rule, and it has since been regarded as a principle of international law. It was expressly so announced by the United States and Spain at the outbreak of the recent war between them. The exemption from capture of private property at sea was one of the subjects discussed by the recent Conference at The Hague. It would be going too far to say that no progress has been made during the past century towards the establishment of such an exemption; but, while it has found strong advocates, it has achieved only occasional practical recognition.

Since 1860 numerous attempts have been made by means of international conferences to legislate on the modes of conducting warfare. On August 22, 1864, there was concluded at Geneva the famous convention for the amelioration of the condition of the wounded in armies in the field, commonly called the Red Cross Convention. Almost all civilised Powers have adhered to this convention, and the observance of its provisions is considered a test of civilisation. Agreements and declarations have also been made as to the nature of the weapons that may be used in war, and as to the treatment of prisoners of war. In this relation we should specify the Declaration of St. Petersburg of 1868, which was framed by an international military commission. Far more extensive, covering almost the whole field of the laws of war on land, is the Project of Declaration of the Brussels Conference of 1874, which, although the Powers represented in the Conference failed afterwards to make it binding, forms the basis not only of the "Manual" formulated by the Institute of International Law in 1880, and of the plan of convention adopted by the Spanish-Portuguese-Latin-American Military Congress at Madrid in 1892, but

also of The Hague Conference rules concerning the laws and usages of war, which now await ratification.

Notice should also be taken, as contributions to the development of international law, of the efforts made in the past century, outside international conferences, to codify various branches of international law, and especially the laws of war. In this particular the nineteenth century should not withhold its tribute to the seventeenth, which, even though its earlier wars were distinguished by barbarities, may yet claim as its own Gustavus Adolphus and his humane code. Nevertheless, we find in the recent acts of various governments a marked advance towards a more comprehensive system. The publication by the United States, in 1863, of instructions for the government of armies in the field set an example which has had a stimulating effect. In July, 1870, ample instructions were issued by the French Government to its naval officers. Russia, in 1877, during the conflict with Turkey, issued to her soldiers a catechism founded on the Project of the Brussels Conference, besides prescribing liberal rules for the treatment of prisoners of war. In 1894, after the outbreak of the war with China, Japan promulgated a comprehensive prize law, based upon the works of jurists, the conclusions of the Institute of International Law in 1882, and the French naval instructions of 1870, and setting the salutary example of abolishing the interest of the individual captor in the prize. In the recent war between the United States and Spain, each belligerent issued systematic instructions for the government of its army and navy, and the Secretary of the Navy of the United States has since prescribed, with the President's approval, for the use of that branch of the service, a Naval War Code, which purports to embody the laws and usages of war at sea.

In the recent development of international law, much influence has no doubt been exerted by unofficial societies,

the activity of which has specially marked the second half of the century. In the case of the Red Cross Convention, the original impulse proceeded from such an association. The Institute of International Law (*Institut de Droit International*), and the International Law Association, formerly known as the Association for the Reform and Codification of the Law of Nations, are leading examples of societies, unofficial in constitution but international in membership, which are devoted to legal progress.

Besides improving the general rules of law, nations have during the past hundred years made great progress in securing by co-operation common interests, the attainment of which can be assured only by special agreements. The tendency towards co-operation may be seen in the treaties, of which the convention signed at Brussels July 2, 1890, may be mentioned as the leading example, made for the purpose of putting an end to the African slave trade. It may also be observed in the adoption, as the result of the Marine Conference at Washington, in 1889–90, of uniform rules of navigation.

In 1883, a number of Powers of Europe and America entered into an international union for the protection of industrial property, and various governments which were not among the original parties have since adhered to it. In the following year, a convention was made between twenty-six states for the protection of submarine cables outside territorial waters. Only two years later, on September 9, 1886, a treaty was concluded at Berne for the protection of property in literary and artistic work. To this treaty, which is commonly called the International Copyright Convention, the United States was not a party; but it may perhaps be said that a step towards its acceptance was taken in the act of Congress of 1891, by which foreign authors and artists were for the first time enabled to copyright their works in the United States as well as at home. One should also mention as measures

of co-operation the various international agreements that have been made in recent times for the regulation and protection of fisheries on the high seas.

By the process of national consolidation, which specially marks the latter half of the past century, international relations have been profoundly affected. Multitudes of petty states, with diverse interests and claims to distinction, have been absorbed into great national organisations. If international relations have not, in consequence of this absorption, lost any of their seriousness and importance, they have in a sense become more simple, and the possibilities of international co-operation, whether for the improvement of law or the protection of common interests, have increased. But, while the situation has thus been simplified, there has also been a significant widening of the circle in which are included the states that acknowledge the obligations and enjoy the advantages of international law. As the law of nations was originally the product of the Christian states of Europe, nations were classified, with reference to its acceptance and rejection, as Christian and non-Christian. With the admission of Turkey, by the Treaty of Paris of 1856, "to participate in the advantages of the public law and concert of Europe," this classification ceased to be accurate. Lately, we have witnessed a further enlargement of the circle by the admission of Japan. The admission of those states to the concert of nations does not signify that the standards of international law have been altered or abandoned. On the contrary, it denotes a more general acceptance of those standards as the test of advancement in law, in morals, and in civilisation.

HISTORY

ENGLISH POLITICAL DEVELOPMENT IN THE CENTURY

By Arthur G. Sedgwick

THAT the end of the American war did not prove the immediate signal for the beginning of an era of change and progress in England was owing to the excesses of the French Revolution; this plunged her into a war of self-defence against Napoleon, and thus obstructed for the time all attempts at liberal government. External war on a large scale closed, as it always does, all discussion of domestic questions. In this way the fate of the old *régime* in England was arrested, and the reforms which Pitt was ready and eager to introduce at the end of the last century were postponed for a generation. One of the delusions fostered by the reactionaries of the present day is that the greatness of England as we know it was due to the wars in which she had been engaged before it began; and many people, both in England and America, seem to cling to the idea that Pitt was an early Jingo Minister, who laid the foundation of England's empire by getting together a great army and navy with the deliberate purpose of world-wide expansion.

Pitt, in fact, came to office a Liberal Minister, fresh from the study and fired with the ideas of Adam Smith's *Wealth of Nations*. Peace and internal reform were his objects, and he attempted not merely to draw, as he said, "what remained of the shattered empire" together by introducing freedom of trade between Ireland and England, but even to disfranchise the rotten boroughs, nearly

fifty years before this reform was carried. He clung to peace until he was actually driven into war, and proved by his financial and other proposals that, had he been free, the close of the American war would have been at once followed by a period of Liberalism. Pitt's earlier career remains to show that he was a forerunner of the English reformers of our day, and one of the connecting links in constructive politics between the Liberals of the last century and those of this. It was but four years before his death that there appeared, in the *Edinburgh Review*, a publication destined to be the great organ of a propaganda of Liberal ideas; in 1809, the question of Parliamentary reform was again raised, and even before the battle of Waterloo the House of Commons had voted for Catholic emancipation. But it was not till the end of the Napoleonic wars opened the door to peaceful progress that the Liberals in England had their real opportunity. It was not until 1832 that the first great instalment of electoral reform was wrung from the Government by the people.

At the close of the last century, England was an impoverished, benighted, and backward country. A reduced population of ten millions was oppressed with an enormous debt, which it seemed to be hopeless to attempt to pay. America, the most promising portion of the empire, had been lost through a stupid attempt at subjugation, and Ireland was ripe at any time for revolt. Wealth was so unequally distributed that, while the artificial rise in wheat and land enriched the small class which controlled legislation, the bulk of the population were pauperised. The general level of education was so low that the attempt to introduce machinery into a country destined in large measure to live by means of it led to riots which had to be suppressed by troops. The press was shackled, the bench far from free, the civil service the football of patronage, and crime was steadily

increasing, through the operation of a criminal code so barbarously severe as to be worse than useless. Yet out of these unpromising beginnings has emerged the England of our day — the England of a great literary, scientific, commercial, and political people, a dominion on which the sun never sets, the country which divides with us, her cognate rival and sharer in this progress, the repute of having the greatest resources and greatest enlightenment of modern times, the home of individual freedom and honest administration. If the transformation is not due to the triumph in government of Liberal ideas, to what is it due ?

The most marked trait of the management of their affairs by the English in the nineteenth century (and much of the dislike of them abroad has been caused by it) has been its commonplace rationality. The age which dawned upon the world with the American and French Revolutions was to Bentham and to Burke no less than to Paine, the Age of Reason, and reason in English minds has never been the abstraction which flourished under the same name in France and wherever French philosophy gained a footing. Pure democracies, as the pages of Athenian, of French, and of American history show, have a fondness for abstract principles of government, which is apparently connected with another recognised tendency of democracies — to be carried away by phrases. Both in France and America, the rise of democracy a hundred years ago was marked by attempts to found the system on some broad theory, such as the rights of man, equality, or the social-contract theory. All the great Americans who gave life and form to the movement which ended in the complete democratisation of our institutions, from Jefferson and Franklin to Lincoln, as well as all the French constitution-makers from 1789 to 1848, were impelled by the idea, entertained in some cases with almost religious fervor, that they had

discovered a new principle of government, which, if attended to, would solve the perplexities of its problems, bring to an end the oppression of man by man, and change the world from a vale of tears into an abode of happiness. To the more phlegmatic English, the Age of Reason was to be something different and saner. Burke and Bentham and Adam Smith in their different fields were great rationalists; but they did not dream of making the world over. Bentham appealed to the principle of utility, the greatest good of the greatest number, a purely practical standard; the political philosophy of Burke, which first led him to sympathise with the American, and afterwards to detest the French Revolution, was based on the simple truth, hitherto almost unrecognised, and still only slowly establishing itself in the human mind, that the welfare and decay of states is governed by laws analogous to, and at many points identical with, those which determine the prosperity and failure in life of individuals.

Comte insists that all human knowledge passes through three stages, the religious, the metaphysical, and the positive or rational. There is no field in which the Comtean law seems to work more clearly than that of government. For ages mankind appeals to revelation and divine right; this idea being expelled, we are taught that " equality " or " natural right " is the true substitute. The final stage is reached when it is discovered that the only real appeal is to reason. All the great publicists of the last century guessed the secret. Their followers in England and America applied it.

A real Age of Reason can hardly prove an era of violent change. In England, in the nineteenth century, while institutions have been liberalised, nothing has been destroyed. The terrors of the law have been mitigated; its firmness has not been impaired. The press has been made free without being allowed to become licentious.

Liberty of worship has been established, and in Ireland the connection between Church and State has been dissolved, but the Church has not been despoiled. Slavery has been abolished, but the slave-owners compensated. The control of the Crown and the great landlords over elections has been shaken off, and the House of Commons made strictly representative; but the freedom of the representative to act in accordance with his own convictions has not been tampered with. Trade has been made free, and this with absolute indifference to "reciprocity"; English ports are open to the trade of the whole world, no matter how much any other nation closes its own — the crowning triumph of Liberal ideas as to commerce. The old colonial system in all the large English-speaking colonies has been abandoned, and a federal system of nearly independent states established in Canada and Australia. A blow at privilege in the army has been struck by the abolition of the purchase of commissions. The immense national debt left by the wars with France has been greatly reduced; and a nearly consistent policy of peace with foreign nations pursued. The land question in Ireland, the constant seed of trouble for centuries, has been disposed of, and all these things have been accomplished without resorting to violent or extreme measures or destroying any established institutions. These are the reforms dreamed of in the last century, some of them first introduced in this country.

But the form and theory of the English Constitution are still wonderfully unchanged. It is the fashion to speak of the transformation of English society and government and law and manners which the last hundred years has introduced as the "democratisation" of English institutions; but the word should rather be rationalisation. The State, the Church, the aristocracy, and the Crown still exist as potent factors in the Constitution; privilege plays a great part in the law, and birth and

family count socially for more than they are worth. The House of Commons has been democratised, so far as a wide suffrage can of itself effect this result, and the civil service has been thrown open, and the abuses which Burke said he loved to hear "clamoured against," overthrown; but the actual control of the government is still to a great degree in the hands of the wealthy and titled classes, and when a *novus homo*, like Mr. Chamberlain, rises into power, while this may rest on popular favour, it can only be solidified by that of the governing orders.

The principle of equality, which Mirabeau thought was a good "club" with which to attack privilege, and which was destined to play such a great part in the development of democracy in the United States, has never commended itself to Englishmen; indeed, in most Englishmen's minds the conception of their rights is still connected with inequality. The right, for instance, to a proper amount of deference and respect from inferiors in station, is as well recognised and as thoroughly protected by social sentiment as habeas corpus is by law. No one familiar with life in the United States as well as in England would ever call England a democracy. Even the dogma of the sovereignty of the people, or of the derivative character of the powers of government, has not yet been incorporated into English constitutional theory. The most important constitutional change of our day in the democratic direction was, curiously enough, unconsciously accomplished. When Bagehot published his account of the English Constitution a generation ago, few people in England were aware of how supreme the House of Commons had become, or how its supremacy had been obtained. Bagehot showed how the Ministry (which actually carries on the government) had ceased to be the agent of the Crown, and grown to be a sort of committee representing the party having for the time being the majority of the Lower House. The Crown could no longer refuse

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to call Mr. Gladstone or Mr. Disraeli, as the case might be, to form a Ministry; and as it was admitted that the House of Lords could no longer refuse to pass a bill persistently demanded by the people's representatives, the first inference seemed to be that the English Government had become a Parliamentary democracy with but a single chamber; without even the checks and balances of the American Constitution, or its division of powers and judicial control over the legislature. Sir Henry Maine was so much impressed with this idea that he wrote a book to prove that England had become a " pure " democracy. But even here the democratisation of institutions was not nearly so complete as it appeared on the surface. Through all the changes of the century, the Crown has remained in control of foreign affairs, at the head of the Church and the aristocracy; society and wealth have been its allies, and the great equalising influence of mere numbers, which has played such a potent part in our politics, has, owing to the infrequency of general elections, obtained but a slight control in England.

Of course, it would be absurd to attribute the totality of progress in any country to a single cause. The advances made by science and invention count for much; and every country has had its share in the common progress which has made the nineteenth century mark a turning-point in the world's history. But when we reflect that in every country the great advance was preceded by a struggle between the advocates of freedom and the old order, in which the former were triumphant, and through which they obtained control and shaped the policy of government, the inference is inevitable that free institutions have enormously contributed to the advance. Those in any country who deny that its welfare is bound up with the rationalisation of human institutions have no evidence to appeal to. The pages of their own past are

black with the proof that human happiness, comfort, content, and peace, even in as moderate degree as they have yet been realised, not only did not exist, but (as long as the final court of appeal in Church and State was authority and privilege) were regarded generally as a rather silly dream; they have advanced in the last hundred years *pari passu* with those rationalising changes which in some countries have taken the form of democracy, and in England of deliberate and continuous institutional reform through the growth of popular power.

Had the Liberal or rationalistic movement in England gone on, as many supposed it would, it must have become more democratic, and involved, if not all, some of the changes which democracy has produced elsewhere — the abolition of privilege based on heredity, the disestablishment of the Church, very likely the disappearance of the Crown, and certainly " Home Rule " in Ireland.

Among the causes which contributed to prevent these results we can see that a powerful influence has been the same dread of extremes which led a century ago to the turn in English opinion against the French Revolution. A generation had grown up which had enjoyed all the benefits of rational, free government, and yet had a comfortable state Church, a satisfactory aristocracy and magistracy, an army and navy officered by gentlemen, an excellent press, a well-administered system of justice, a trained and honest civil service, and a full purse. The abuses which the old Liberalism had been called to destroy had been destroyed; the last one had vanished with the disappearance of the Irish land system. Was it worth while to go on, after all this, to introduce democracy, for the sake of making things systematic? America and France had both started pure democracies, but England had secured the benefits of solid, good government without doing anything of the kind. One was full of revolution, and the other of political corruption.

In neither was the government manned by people of birth and social distinction. These feelings were reinforced by the growing Imperialism, introduced by Disraeli, and fostered by all the forces of Church, Crown, and aristocracy. But it was not Imperialism which broke the Liberal party in two under Gladstone, and has kept it divided ever since; it was the aversion for sweeping theoretic changes in the national habits which has always been characteristic of the English people. Many an Englishman left Gladstone without the slightest desire to interfere with freedom in Ireland, saying to himself, "Liberalism is no doubt a good thing; but then you may have too much even of a good thing."

The tendencies, however, of an imperial conservative reaction in such a country are—if there exist any principles of government at all — as easy to see now as they were at the end of the last century. First, war abroad is almost inevitable, and, as Pitt found to his cost, foreign war kills all interest in domestic questions, involves immense expenditure of blood and treasure, increases debt and taxes, checks freedom of speech, discussion, and debate, and gives an opportunity for vested privilege in the Church, the army, the Crown, and the aristocracy to strengthen itself. We can see this process going on now, though we cannot see the end.

The remoter causes which have led to the present reaction against Liberal ideas, the tide of which has been swelling for twenty-five years, are no doubt numerous and diverse. Following upon a *régime* of reason, it seems in some respects like a reaction against reason itself; as if the new generation had got tired, as an individual might, of being reasonable, and were resolved to try something else. It has its economists, who teach that every country, if not every town, city, and village, has its own political economy; its historians, who think that what really improves the human race is violence and

war. Its poet sings the praises at once of law, order, discipline, violence, blackguardism, and brutality. The writers who heralded it, like Froude, Carlyle, and Ruskin, deified force or imagination, laughed at reason, and delighted in ridiculing the absurdities of the economists under the guidance of whose teachings English commerce and the English language have spread over the earth. Its publicists assure us that the secret of the permanent grandeur of free nations is plenty of distant colonies and a huge army and navy, and its priests make a laughing-stock of themselves and the religion they profess, by preaching the sword as the true means of spreading the gospel of peace. The reaction teaches that protection and government bounty, *i. e.*, taxation, is the true source of wealth, and that privilege is the buttress of common right. It is imperialistic and military — *i. e.*, it appeals to the passion for foreign dominion, to greed and pride, while it pretends to be democratic because it appeals to an extended electorate, though its success paralyses every democratic impulse. But there are many causes tending to prevent even a reaction in England from going to extremes—among others the publicity in the glare of which most public events are now transacted. This has in the nineteenth century enabled modern communities to profit by their own experience, and correct their mistakes in a way not before possible; and unless we are entering on a period of universal war, the freedom of the press is not likely to disappear. The reactionaries are perfectly right in feeling that war is what their cause needs, and one of the most curious phenomena of the period is the vogue in England of a writer like Captain Mahan, who overnight appeared to succeed in convincing the English that their position as a maritime nation was founded, not, as they had hitherto supposed, on their commerce, but on the size of their navy and the number of naval stations all over the world which it might be called upon to defend.

It may be observed that foreign relations—the stronghold of this and every other reaction — have never been rationalised in England, nor completely in any country. The Foreign Office is the only secret branch of government left; and through it the Executive retains, no matter what the nominal constitutional checks, the privilege of plunging any country into war without notice, and of explaining the event in any way it chooses. At the same time, none of the great Powers, even of those who have most to gain by it, is ready to diminish the risk of war by agreeing in advance to arbitrate its differences. This makes it almost as easy to-day as it was a hundred years ago for a government to get up a war for one reason, and inflame the public into support of it by other and totally different reasons; as we have just seen done in the Spanish-American, the Philippine, and the Boer wars. Experience shows that no government function that is secret can long be honestly and properly administered. This is why the doors not only of courts of justice, but of the legislature and other public bodies, have been thrown open. Perhaps the time will some day come when the same principle will be seen to apply to the transactions of states between themselves. The principle of arbitration would of itself entail publicity as to all international differences. It is in foreign affairs — even in England — and in the minds and purposes of its present reactionary leaders, that the system of Machiavelli still works in full force.

On the whole, the events of the century in England tend to establish, among others, the following conclusions:

(1) That there is no intimate connection between the mere form of a government and national prosperity. In England we find, at the height of its prosperity, monarchy, aristocracy, and democracy existing side by side.

In South America we find democratic forms producing very little prosperity.

(2) That the conservative opinion so long maintained that the popularisation of institutions necessarily produces disaster, tumult, and anarchy is a mistake, the extraordinary prosperity of England having advanced *pari passu* with the popularisation of her institutions.

(3) That one of the secrets of prosperity is the emancipation of trade and industry, so far as possible, from all forms of control. The "open door" of which we now hear so much is only an illustration of this principle.

(4) That public business cannot be managed behind closed doors without becoming the private business of those who carry it on.

(5) That wherever government is popular and representative, success in the management of public affairs is dependent wholly on conscious, determined effort at improvement, exactly as is the case with individual effort at self-improvement in private life. For obvious reasons, free states are more likely to make such an effort than states managed by families, castes, or orders in their own interests.

(6) That the way to secure competency, fitness, and honesty in the public service is to follow the methods pursued in private life.

(7) That the worst way to settle any public question is violence, *i. e.*, war. During the period of England's great prosperity, 1850–80, she engaged in no important foreign war except that of the Crimea, which was inconclusive and useless.

The enthusiasts of the last century were laughed at for putting these ideas into people's heads. The reactionaries of to-day are trying to disprove them. We have in the contemporary history of England a monumental indication that the task will be an impossible one.

GERMANY IN THE NINETEENTH CENTURY

By Munroe Smith

In a century characterised by unprecedented changes in the economic, the social, and the political life of the civilised world, no European people has made so substantial an advance as the German. At the close of the last century Germany was little more than an ethnographical conception; to-day it is a strong federal state. Then its people had practically no voice in legislation and no control over their governments; to-day they have local self-government and representation in state legislatures and in an imperial Parliament. Then it was substantially an agricultural country; to-day it is the second of the European states in industry and commerce.

At the outbreak of the French Revolution, the Holy Roman Empire of the German nation still extended over a larger area than that covered by the present Empire, but its unity was a legal fiction. It included the principal territories of two European Powers, Austria and Prussia; and, by virtue of hereditary possessions or conquests within its boundaries, the kings of Great Britain, Denmark, and Sweden were numbered among its princes. It included more than three hundred ecclesiastical and secular principalities; some sixteen hundred imperial knight-fees, each knight ruling, on an average, less than three hundred subjects; half a hundred free imperial cities, and nearly as many imperial villages. All of these two thousand political units were "immediate" — that is, no one stood between them and the Emperor; but

over none of them had the Emperor any real authority. Such governmental power as still resided in the Empire was held by the princes and the free cities, acting collectively, but from these estates it had become impossible to secure any important action. Within the single territories there was a thoroughly mediæval variety of forms of government, but by far the greater part of Germany was ruled absolutely, and in many cases despotically.

The law of Germany was as multiform as its politics. There existed an imperial code of criminal law and procedure, dating from 1532, but local customs and laws took precedence over its provisions. In private law, the apparent unity established at the close of the Middle Ages by the reception of the Roman laws, civil and canon, was (fortunately for Germany's future) far from complete. The old German law held somewhat of its own in the form of innumerable local customs; and these, left isolated, grew more and more diverse. In consequence of the Reformation, the Roman canon law lost its universal authority, and in half of Germany, church and family relations were governed by Protestant ecclesiastical law. Finally, as the greater territories rounded into states, new codes, criminal and civil, began to appear, each, of course, different from the others. A far more serious matter than the diversity of local and confessional laws was the diversity of legal rules for different social classes. The law not merely recognised class distinctions, but endeavoured to perpetuate them. As elsewhere on the Continent, the great bulk of the people were bound to the soil in hereditary serfdom.

Non-agricultural industry, except of the simplest sort, was restricted to the towns and governed by the guilds. Trade was fettered by guild regulations, embarrassed by variations of weights, measures, and coinage, and impeded by transit tolls on roads and rivers as well as by import and export duties. The number of petty sov-

ereigns levying tolls and duties made this burden almost intolerable; but the rulers of the larger states increased it by barring province against province and city against country. On the high seas, where the German merchant escaped from these impediments, he was handicapped by lack of protection; for neither the Empire nor any of the German states possessed sea-power. Under such conditions, neither industry nor commerce was able to develop freely; and, until the present century was well advanced, Germany remained essentially an agricultural country. The population of the territories which constitute the present Empire cannot have been, in 1800, more than 22,000,000.

In consequence of its disunity Germany had become the battle-ground of Europe, and had lost much of its earlier bulk. In the wars occasioned by the French Revolution, it suffered further losses and even greater humiliation. Austria and Prussia were deprived of most of their Polish territories. Austria lost also its western and south-western frontiers, and with the latter all its Mediterranean ports; Prussia lost all its provinces west of the Elbe. The entire left bank of the Rhine, and north-western Germany as far as Lübeck, were annexed to France. The rest of Germany—all that was not (or was no longer) Austrian or Prussian, and all that was not Swedish or Danish or French — entered into alliance with Napoleon and formed a confederation of which he was protector. Of all the changes of these tremendous years, the passing of the old German Empire seemed the least revolutionary. It was, in fact, but the tardy burial of a thing long dead.

These catastrophes were the beginning of the making of the new Germany. When the left bank of the Rhine was ceded, in 1801, nearly a hundred German principalities and free cities and a great number of knight-fees were transformed into four new French departments. When the secular princes who had lost territory by this

cession were indemnified at Regensburg in 1803, the indemnifying material was obtained by mediatising all of the remaining free cities but six, and all of the ecclesiastical territories but two. In the formation and development of the Rhenish Confederation, Napoleon sacrificed another hecatomb of petty principalities, two more free cities, and all the rest of the knight-fees. In the course of these changes the immediate imperial villages also disappeared. When Germany was restored to its pre-revolutionary boundaries in 1815, it consisted of but thirty-eight political units: Austria, Prussia, and four smaller kingdoms; twenty-eight grand duchies, duchies, and principalities, and four free cities.

French rule gave Germany some of the best results of the French Revolution. Feudal tenures of office and of land, manorial jurisdiction and serfdom, all privileges and disabilities of birth, were swept away. Religious liberty was established, and all religious disabilities were removed; Jews were admitted to citizenship. The law was simplified; legal proceedings were conducted orally and publicly, and trial by jury was introduced in criminal cases. Industry and trade were freed from the restrictions of the guilds; provincial customs lines disappeared; a uniform system of weights, measures, and coinage was established. It is scarcely an exaggeration to say that the territories annexed to France were brought at one bound out of feudalism and the Middle Ages into the nineteenth century and the modern state. Similar reforms were introduced, in greater or less measure, in most of the states of the Rhenish Confederation; and the benefits introduced by French rule or French influence were retained, for the most part, when France was driven back within her old boundaries.

In Prussia, also, after the catastrophe of Jena had demonstrated the necessity of a thorough political and social reorganisation, many similar reforms were initiated.

Hereditary serfdom was abolished throughout the kingdom. The peasants, however, were not relieved from their compulsory services; and not until 1821 were these services replaced by rent-charges. An attempt, initiated in 1811, to create peasant freeholds by dividing the land between the peasant occupants and the lords of the manors, and by freeing the land allotted to the peasants from all services and burdens, was strenuously resisted by the nobles; and in the end only a minority of the peasants received allotments. The majority, especially in the eastern provinces, fell into the position of landless day-labourers. These, deprived of the hope of bettering their position, have emigrated in such numbers, particularly during the latter half of this century, that the landholders have long been embarrassed by the scarcity of agricultural labourers.

Other Prussian reforms, similar in character to those introduced through French influence, were the establishment of religious liberty and the removal of the disabilities of the Jews; the abolition of class and guild restrictions upon the purchase of land and upon the exercise of industries and trades; and the reform of the central administration. Two new things, however, appeared in Prussia in this period — things that were not inspired by the French example, and that were destined, beyond all other reforms, to strengthen Prussia and to place it at the head of a united Germany. These were the system of local self-government, established by the Cities Ordinance of 1808, and the system of universal military service, without the French right of exemption by substitution. The reforms introduced in Prussia and the patriotism and devotion of its people enabled this state, in spite of the fact that it had been reduced to a population of 5,000,000, to take a leading part in the War of Liberation and to reappear in 1814, at the Congress of Vienna, as a state of the first rank.

From the War of Liberation the German people emerged with a stronger sense of national unity and a stronger desire for national organisation than they had ever before manifested. Almost equally strong was their desire for a share in the life of the state, for constitutional government. Neither of these desires was satisfied by the arrangements made at Vienna in 1815. The Congress of Vienna united the German states and cities in a German confederation, and declared that each state would establish a constitution representing its territorial estates; but the confederation was so loosely organised as to prove impotent, and the promise of constitutional government was not, as a rule, loyally interpreted or promptly fulfilled in the single states. In the first years of the confederation, the South German kingdoms and a few of the Central German principalities gave their subjects representation in legislatures of the modern pattern. In a considerable number of principalities, estates of the mediæval type, with preponderant representation of the nobility, were established or re-established. In the majority of the German states, including Austria and Prussia, no constitutions were granted.

The political history of Germany from 1815 to 1866 is a record of popular revolutions, incited by the example of France, with intervening periods of princely reaction. In 1830 and the following years, several more German states obtained representative constitutions, but no step was taken toward the solution of the German question. In 1848, the German people made a vigorous effort to solve both questions, that of liberty and that of unity. Thoroughly intimidated by the apparent strength of the movement, the princes gave way. In all the states with modern constitutions liberal reforms were introduced or promised; in all the other states constitutions were granted; and with the sanction of the Federal Diet, a constituent Parliament, elected by manhood suffrage and

secret ballot, met at Frankfort, set up a provisional government, and proceeded to frame a constitution establishing a German Empire. Against its own will this Parliament was constrained by the logic of the situation to accept the scheme originally supported by a minority —to exclude Austria from the proposed Empire, and to offer the imperial crown to the King of Prussia. With the refusal of the crown by the elected Emperor, the movement failed. The attempt made by Prussia in 1849, to establish, by compact between the princes, a somewhat similar but less centralised union also came to nothing. The princes agreed, at first, because Austria was struggling for its existence against national revolutions in Italy and Hungary, and could not defend its German clients against Prussia. In 1850, when Austria, with Russia's help, had fought itself out of its difficulties, Prussia was obliged to submit to the Austrian demands, and the German confederation was re-established.

During these decades, the only really important achievement in the direction of German unity was the establishment and gradual extension, under Prussian control and guidance, of a German customs union. In 1818, Prussia broke down all customs lines between its various provinces, abolished all city octrois, and established for the whole kingdom a uniform tariff on imports. At the same time it invited its neighbours to come within its customs lines, and, by imposing heavy transit duties upon their merchandise, made it difficult for them to remain outside. During the next ten years, but three states accepted the Prussian invitation. The rest endeavoured to escape union with Prussia by forming independent South German and Central German customs unions. Resistance, however, was futile; and, in 1834, the German Customs Union was formed, including by far the greater part of the German states. The Prussian statesmen comprehended from the outset, and the advers-

aries of Prussia soon realised, the political importance of this union. Austria, which had viewed its establishment with indifference, endeavoured to frustrate its extension, and finally demanded admission, but the demand was refused.

Education made great advances during this period. Not only were the German universities recognised as the first in the world, drawing an increasing number of students from other lands, but secondary education was broadened by the establishment of Latin-scientific schools, and the primary schools were greatly improved. Much, however, was left to be done by the next generation. In the province of Posen forty-one per cent. of the recruits of 1854 had received no schooling at all.

Bismarck has left on record his conviction that if the narrower German unity under Prussia's leadership had been established in 1849, the wars with Austria and with France would have followed, instead of preceding, its establishment. Certainly the final and decisive reason why Prussia abandoned the undertaking in 1850 was the weakness of its army. The principle of universal military service had not been abandoned, but the standing army had not been kept sufficiently large to train all the able-bodied young men. When William I. assumed the regency (1858), less than two thirds of those owing military service actually passed through the standing army; the rest were put, without adequate training, into the territorial militia (*Landwehr*). William proposed to increase the annual levy from 40,000 to 63,000, to lengthen the term of service in the first reserve, and to excuse the Landwehr from the first call in case of mobilisation. The Deputies refused the necessary appropriations, but with Bismarck as his Prime Minister, the King executed his plan in defiance of the will of the majority of his people. For four years the government was carried on without a legal budget. During this period, Schleswig and Hol-

stein were wrested from Denmark, but the Prussian people remained firm in their opposition. Throughout Germany, the attitude of the Prussian Government so alienated Liberal sympathies that the establishment of national unity by revolution from below, on the lines of the movement of 1848, became impossible. Nothing was left but revolution from above; and this Bismarck carried through in 1866. In alliance with Italy, Prussia defeated the armies of Austria and of the principal German states. The hostile temper of the majority of the South German people and the opposition of Napoleon restricted German unity for the moment to the line of the Main. In North Germany, however, a strong federal union was established. Prussia annexed Schleswig-Holstein, Hanover, Electoral Hesse, Nassau, and Frankfort, and formed with the remaining states the North German Confederation. The constitution of this Confederation was submitted to and amended by a German constituent Parliament, chosen according to the election law drafted by the Parliament of 1848. The sovereignty of the new federal state was vested in the allied princes and cities, represented in a Federal Council. The more important executive powers were intrusted to the King of Prussia as Federal President. The legislative power was placed in the Federal Council and an Imperial Diet elected by manhood suffrage and by secret ballot. This substantial realisation of the programme of 1848 effected a great change in public opinion, and for a dozen years Bismarck had a working Conservative and Liberal majority in the Prussian and Imperial Diets.

The war with France in 1870–71 brought the South German kingdoms into the national union on practically the same footing as the other states. This enlarged union now took the name of Empire, and King William assumed the title of German Emperor. The peace with

France increased the territory of the Empire by the cession of Alsace and a part of Lorraine.

Placed as it is in central Europe, without natural boundaries to separate it from the surrounding nationalities, the German people has never possessed a well-rounded or perfectly defined ethnographic territory; and even if states could be built on purely theoretical lines, it would be difficult to construct a Germany that should include all areas in which the German element predominates and exclude all others. In the new Germany, however, such a result is at least approximately attained. The Empire includes more than four fifths of the German-speaking inhabitants of Europe; and not more than one sixteenth of its population inhabits areas in which anti-German feelings are dominant. The population of the territories included in the present Empire, which, in 1816, was less than 25,000,000, has risen, in spite of heavy emigration, to 56,000,000 and is increasing at the rate of more than one per cent. annually.

In consequence of the extinction of reigning lines, voluntary cessions of sovereignty, the Prussian annexations of 1866, and the exclusion of Austria and Luxemburg, the Empire includes but twenty-five states—four kingdoms, eighteen grand duchies, duchies, and principalities, and three free cities. These states vary in size from Prussia, with nearly 34,000,000 inhabitants, to Schaumburg-Lippe, with about 43,000. In all the monarchic states except Mecklenburg there is now constitutional government of a modern type. Mecklenburg has a mediæval diet of great landholders and city magistrates. Of the free cities, Lübeck has a government of a restricted democratic type; Hamburg and Bremen have governments of a mixed type.

In the Empire, the federal principle is asserted, and the rights of the smaller states are safeguarded by the distribution of votes in the Federal Council. Not only has

Prussia, with three fifths of the total population, no majority in the Council, but it would be possible for a combination of small states, including less than one fifth of the total population, to outvote Prussia and the remaining states. So long, however, as Prussia refrains from threatening the rights of the little states, no such combination can be made; and the Emperors and their Chancellors have thus far worked in substantial harmony with the allied sovereigns and their representatives. They have found it more difficult to secure support for their measures among the representatives of the people; partly because German political parties are so numerous that none has ever possessed anything like an absolute majority in the Imperial Diet—a fact which forces the Government to work with coalitions—and partly because certain parties are always in uncompromising opposition—a fact which restricts the range of possible combinations. Until Bismarck adopted a protectionist policy, he was able to hold together a majority composed of Conservatives and moderate Liberals. Since that time he and his successors have had to make terms with the Centralists, who represent the interests of the Roman Catholic Church.

In spite of these difficulties, the imperial government has been carried on without overmuch friction, and its chief aims have been realised. By the development of indirect taxation, the Empire has been made financially independent of the single states; and the army has been enlarged, from time to time, to keep somewhat more than even pace with the growth of Germany's population. Its peace footing, which in 1875 was 405,000, is now 600,000; and the military expenditures, which in 1872 were not quite 292,000,000 marks, amount in the budget of 1900 to nearly 666,000,000. The burden of military service, however, has been lessened since 1893 by reducing the normal period of service in the standing army to two years.

Imperial legislation has been productive of other things besides soldiers and taxes. In the period of the North German Confederation and in the first years of the Empire, it completed the work begun in the period of French supremacy. It swept away many remnants of mediævalism that lingered in out-of-the-way corners of Germany. It gave the labouring man the right of free migration, and it liberated industry and trade from all remaining restrictions of the eighteenth-century pattern. It also created a uniform system of state courts, with an appeal to the Supreme Court of the Empire at Leipzig; it placed the judiciary beyond the control of the Administration, and it has gradually unified, in a series of imperial codes, criminal and civil law and procedure. In the field of state legislation, the most important achievement of the period was the elaboration, in 1872, of a general system of local self-government in Prussia. Of the measures adopted during the conflict with the Roman Catholic Church, little remains except the secularisation of the Prussian primary schools and the expulsion of the Jesuits from the Empire. Education is nowhere neglected. The percentage of illiteracy among the army recruits in 1898 was less than half of one per cent. in the most backward district, East Prussia, and less than one fourteenth of one per cent. in the Empire. In Hanover, among nearly 11,000 recruits, there were no illiterates.

During the second half of this century Germany's economic conditions have been as completely revolutionised as its political organisation. The removal by legislation of artificial checks upon industry and enterprise, and the establishment, in the Customs Union, of free trade throughout the greater part of Germany, with a moderate degree of protection against the rest of the world, were followed by a rapid increase of manufactures and trade. Since 1870, there has been an even more rapid development of Germany's foreign commerce. In

its total foreign trade, imports and exports, Germany has forged ahead of France and now holds the second place in Europe. Germany's success in the world-market is due, in large measure, to the co-operation of German science with German industry, and to the establishment of technical and commercial schools of a high type. The change which this industrial and commercial development has brought about in Germany itself is very striking. In 1882, the agricultural population of the Empire exceeded the industrial by three millions; in 1895, the industrial population exceeded the agricultural by a million and three quarters. During the same period the number of persons living by trade and commerce increased by one million and a half. Twenty years ago Bismarck declared that only by the development of its manufacturing interests could Germany give employment to its increasing numbers and stem the tide of emigration. At the close of the century it seems as if this result had been attained. German emigration over sea, which has amounted during the century to six millions — which in 1853 was 318,000, and in 1881 221,000 — has gradually decreased until in 1898 and in 1899 it was less than 24,000.

The development of the German merchant marine has been accompanied by the development of a German navy, and—the flag following trade—the extension of German commerce has led to the inauguration of a colonial policy. A Prussian navy was started in 1844, with a single corvette. The revolutionary German Government of 1848 built a fleet to fight the Danes, but, in 1852, the Federal Diet ordered its dissolution and the ships were sold at auction. With the establishment of the present Empire, provision was again made for an imperial navy; and, in 1880, this navy was reckoned the third strongest in the world. In 1897, however, Germany had fallen back to the sixth place. In the following year the Emperor secured from Parliament authority for the building of a

number of new vessels, and during the year 1900 a still more extensive programme of construction was sanctioned.

Germany's foreign empire was started, in 1884 and 1885, by the proclamation of a protectorate in various unoccupied territories in Africa and in the Pacific Ocean, where German merchants had established themselves. Bismarck declared that these dependencies were not regarded by the Imperial Government as fields for German colonisation, but as markets for the output of German industry. In 1897 Germany seized the harbour and city of Kiao-chau and secured from the Chinese Government a long lease of adjacent territory. It has since asserted a sphere of influence embracing the whole province of Shantung. In 1899, Germany purchased from Spain the Caroline, Pelew, and Ladrone Islands. In 1900, by arrangement with Great Britain and the United States, it established exclusive control over the greater part of the Samoan group. Thus far, the dependencies have not been remunerative. In the imperial budget for 1900, 21,877,000 marks were appropriated for the administration of the African territories alone; and of this sum 16,214,000 marks were to be supplied by the taxpayers at home. Germany's exports to these territories in 1899 were valued at 15,108,000 marks.

Before the law all Germans are equal; but socially there are marked class distinctions, which are not without influence in the matter of appointment to office. Nobles are still preferred to commoners in the army, in diplomacy, and, to a less extent, in other branches of governmental service. The middle class, the bourgeois, has made the greatest advance in the last hundred years. It holds nearly all the new wealth that is now accumulating with unprecedented rapidity. Little of this finds its way into the hands of the nobles, except by marriage.

While the condition of the peasants has improved, the artisan class has suffered, as in other countries, from the

development of the factory system. Wages have risen faster than the necessaries of life, and the cheapening of products has brought many things within the reach of the labourer which at the beginning of the century would have seemed unattainable luxuries. But his work is harder and more monotonous, and employment is more uncertain. The evolution from status to contract has made him more independent, but it has destroyed the ties which formerly subsisted between master and man, binding them to each other in relations that were not exclusively economic, but also human. The discontent of this class has found expression in the Social-Democratic party. From 1878 to 1890, a fruitless attempt was made to suppress this party by special laws. At the same time serious efforts were made to improve by legislation the positions of the workingmen — efforts which culminated in a remarkable scheme of state-assisted compulsory insurance against accident, disease, and old age. Whatever the ultimate results of these laws may be, they have as yet done nothing to check the growth of the Social-Democratic party, which has increased its representation from two in 1867 to twenty-four in 1884, and fifty-seven in the present Diet, and which, at the election of 1898, cast twenty-six per cent. of the total vote. It appears, however, that as this party grows stronger, it is becoming less uncompromisingly intolerant of the capitalistic *régime*, and more inclined to aid in bettering the position of its constituents, the workingmen, within the existing social order.

The transformation of the Social Democracy into a radical reform party ought to be accomplished more easily in Germany than in any other modern state, for the Hohenzollern traditions are socialistic, and no other state has travelled so far as Prussianised Germany along the road of practical state socialism. Germany's triumphs in the struggle for economic supremacy, like its

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victories in war, have been achieved by a high degree of organisation. The system, however, which assigns to each individual his place and function in a vast mechanism secures effective co-operation at no little cost; it sacrifices, in some measure, personal self-reliance and individual initiative. In the contest for the trade of the world with which the nineteenth century closes, German socialism is fairly pitted against Anglo-American individualism. Financial crises such as that which overtook Germany in 1873 prove nothing, for these occur everywhere; but before the close of the twentieth century the world may well expect new, if not conclusive, evidence regarding the relative superiority of the two systems.

THE EXPANSION OF RUSSIA IN THE NINETEENTH CENTURY

By A. C. Coolidge

At the opening of the nineteenth century, the Russian Empire, with a territory of some seven and a half millions of square miles, was by far the largest state in the world. Its population, however, of, say, forty millions, though greater than that of France or Germany, was smaller than that of the part of India already under British control, and insignificant compared with the teeming swarms in China. The huge, thinly settled dominions of which Alexander I. became ruler in March, 1801, extended over three continents; and except where they reached the seas, which for the most part closed them in rather than served as outlets, and except where they were cut off from China by the range of the Tien Shan Mountains, they lacked almost everywhere natural geographical boundaries. Since then the growth of Russia has been of a twofold kind, namely, the filling up of vacant spaces within her own borders, and an expansion along obvious lines; for, over and above the ambition of individuals and the accidents of historical development, we can perceive the great natural forces which have determined her march towards the open sea and towards immediate contact with the firm limits of the other chief Powers of the civilised world. On the other hand, it is noteworthy that certain impulses which have often built up empires have in her case been conspicuously absent. Even in Russia the days of crusades are nearly over, while those of com-

mercial expansion are only just beginning. Nationalism, too, which has made modern Germany and Italy, although it has led the Government of the Czar in this century to attempt with more or less success the Russification of his subject peoples, has not influenced changes of boundaries. The partition of Poland had already brought under one rule all the branches of the nationality (Great, Little, and White Russians) except the three millions of Little Russians once Polish subjects, now Austrian, and in religious communion, under their own rites, with Rome, not Moscow. United Russia has, with this exception, long been a fact, and the shallow, unpractical doctrines of Panslavism have brought no lost sheep into the national fold.

For the sake of clearness, we shall trace the changes first on one and then on another of the frontiers of the Empire, rather than follow a strictly chronological order, noticing at the outset that almost all the gain since 1815 has been made in Asia, while the European acquisitions belong to the earliest years of the century, and Russian America has ceased to exist. We thus get the keynote to the policy that has been followed and the ground of its success. Progress has been made along the lines of least resistance and most profit. There has been comparatively little desire to annex thickly settled regions inhabited by highly civilised peoples; and, at the other extreme, the region we now call Alaska was abandoned as too remote to be worth the effort of retaining. Russian territory is hence not only larger, but more compact, than it was a century ago.

Beginning with the European and north-western frontier, the first great acquisition of the Czars in this century was the province of Finland. Finland had been for six hundred years a part of Sweden; the upper classes and the populations of the towns spoke Swedish, and the whole people had accepted Lutheran Protestantism. In

spite also of some discontent, chiefly among the aristocracy, the land as a whole was perfectly loyal to the Government at Stockholm. What made a Russian conquest of Finland almost inevitable sooner or later was the position of St. Petersburg. Peter the Great founded his capital on his enemy's soil, and even the victorious treaties concluded by him and by his daughter Elizabeth still left the town within a few miles of the frontier. How great the danger might be was shown in 1789 by the sudden attack of Gustavus III. of Sweden, at a moment when the Russian armies were in the far south operating against the Turks. Probably nothing but the mistakes of the Swedish King and the disloyalty of his officers saved Russia on this occasion from the humiliation of seeing her capital fall into the hands of the enemy. The peril still existed, for, however weak Sweden was herself, her territory might be used as a base of operations by some stronger Power. It is not remarkable, then, that Alexander profited by the first opportunity of despoiling his neighbour, showing, indeed, little scrupulousness as to his methods. In 1807, his coalition against France had failed, for Austria had submitted to Napoleon after the battle of Austerlitz, Jena had made the conqueror master of Prussia, and Friedland exposed the Czar's own lands to invasion and to the dangers of a Polish revolt. He accordingly reversed his policy, and, after the interview on the raft in the Niemen and the Peace of Tilsit (June 7, 1807), the two sovereigns, now sworn friends, agreed to combine against England, and to divide the Continent of Europe as suited them. In return for a free hand in the west, the French Emperor abandoned Sweden and Turkey to the Czar. If in this transaction we can hardly blame Napoleon for showing little tenderness for his fanatical opponent, Gustavus IV., who had declared him to be the beast of the Apocalypse, Alexander might have been expected to have some hesitation

in attacking a recent ally who had given him no real provocation. Even though the blindly foolish conduct of Gustavus did furnish the pretext wanted, the act was one of cold-blooded and successful rapacity. Finland, in spite of the bravery of her troops, was badly defended, owing to the incompetence of the King and some of his officers. By the Treaty of Frederikshamm (September 17, 1809) Sweden surrendered the province, and three years later, Charles XIV. (the former French Marshal Bernadotte) actually entered into an alliance with Russia, accepting definitely what had happened, in return for the prospect of getting Norway.

Thus Finland was added with little difficulty to the territories of the Czar, but the circumstances connected with the acquisition are a burning question to-day. Alexander I. had been brought up in the cosmopolitan ideas of the eighteenth century, so different from the rabid nationalism of the present time. He was as anxious as anyone to enlarge his possessions, but the idea that they must have an exclusive Russian character was not one that would appeal to a prince and court whose language in every-day life was French. Then, too, in this, the earlier period of his reign, he was full of liberal dreams. His sentimental nature saw no incongruity in his being at the same time autocrat of all the Russias and constitutional sovereign of peoples used to a freer form of government. As a result, he treated Finland with startling liberality; he made it a grand duchy, almost independent of Russia, except in foreign affairs; he gave it a constitution based on the former one of Sweden, and he even added to the province that part of its lands that had been conquered and taken away by Peter the Great and Elizabeth. Under this *régime*, Finland has greatly prospered; unfortunately, however, the prosperity has not unnaturally excited the anger and envy of Russians. They point out that the grand duchy has had all the advantages of its

connection with a mighty Empire without bearing its proportionate share of the burdens, and they declare that what a Czar has given a Czar can take away, and that the promises of Alexander I. cannot be regarded as binding on his successors when they entail an obvious injustice to the rest of his peoples. More than once has the autonomy of Finland been menaced, and at the present time, when the reaction against Liberalism is still dominant, and when Russia, like many other countries, is under the fierce influence of a national spirit that would like to impose one language, one law, and even one religion on all the peoples of the Empire, the privileges of the grand duchy are more than menaced. Already the separate tariffs, stamps, and coinage are gone; the army is to be raised to the same proportionate strength as that of Russia, and practically incorporated with it; affairs common to all parts of the Emperor's domains are to be settled in St. Petersburg alone; Russian will be the official language, and more is yet to come. The Finns have protested and entreated, but as they are far too weak to be able to offer forcible resistance, their ultimate fate would seem to be only a question of time.

The same spirit which influenced Alexander as regards Finland dictated his conduct towards his Polish provinces. Although of the three Powers that had partitioned Poland Russia had obtained the largest share, she had acquired comparatively few subjects of strictly Polish blood. The great majority of the genuine Poles (with their two capitals, Warsaw and Cracow) had fallen to Prussia and Austria, while the Empress Catherine had taken territories chiefly inhabited by Lithuanians and Little and White Russians, which she might hope in time to assimilate with the rest of her Empire. Alexander I. early showed an eagerness for all the Polish territory that he could get. At the Peace of Tilsit it was arranged that he should obtain the province of

Bialystok, at the expense of his faithful ally the Prussian King; at the Peace of Vienna (1809) he was given the district of Tarnopol in Galicia in return for his pretence of assisting Napoleon in the war against Austria; in 1814 and 1815, at the Congress of Vienna, he pushed to the verge of a general European conflict his claim to the whole grand duchy of Warsaw, and yielded only to the combined opposition of Austria, England, and France, which forced him to content himself without Galicia and Posen. But Alexander's policy in all this was far from being a national one; on the contrary, under the influence of his friend Prince Czartoryski, he recreated the constitutional kingdom of Poland, the old rival, and at one time the dangerous enemy, of Russia; and he even would have given to it the disputed Lithuanian territories but for the unanimous opposition of his Muscovite subjects. However well meant, it is very questionable whether the experiment tried in 1815 was not doomed to failure from the outset. Since that time the frontiers of the Czar's dominions in this region have remained unaltered; but the kingdom of Poland disappeared after the insurrection of 1830, and its last national privileges were taken away after that of 1863.

When we turn to the south, we find that the war between Russia and Turkey, which ended with the Peace of Bucharest in 1812, gave to the Czar the territory of Bessarabia between the Dniester and the Pruth. Alexander's proverbial good fortune served him well here, as, in order to use all his forces against Napoleon's great invasion, he needed peace, in spite of his victories, more than did the Turks. Seventeen years later, by the Peace of Adrianople in 1829, Russia acquired the islands of the Danube delta, which she lost again in consequence of the Crimean War and has never got back, though the part of Bessarabia that she was deprived of after her defeat was returned to her by the Treaty of Berlin. Her frontier

is thus practically the same as it was after 1812, though she has a different neighbour. Instead of the Ottoman Empire, which she now no longer touches in Europe, she is contiguous to the independent kingdom of Roumania.

In the mountainous regions of the Caucasus, the spread of Russian rule has been marked by an almost uninterrupted series of wars and expeditions during the first three quarters of the nineteenth century. Already, in 1783, Heraclius, Prince of the Christian state of Georgia, had put himself under the protection of Catherine II. This led to war with the Shah of Persia, who claimed the overlordship of the country. Paul I. withdrew the Russian troops that had been sent, but, in 1801, the last Prince of Georgia abdicated in favour of the Czar, and Alexander I. promptly dispatched fresh forces to the rescue. In 1803 and 1804, the Georgian dependencies of Mingrelia and Imeritia were taken over, and hostilities with Persia continued until the Treaty of Gulistan in 1813, by which Russia obtained not only Georgia and its appurtenances, but also the coast of the Caspian at the eastern end of the Caucasus, including the famous pass of the Iron Gates. The war of 1826–28 brought a fresh accession of Persian territory, in the shape of the provinces of Erivan and Nakhchivan, with a frontier extending to Mt. Ararat. The fierce mountaineers of the main chain, however, especially the Circassians in the west and the Lesghians and Tchesmeans in the east, long defied the efforts of the great armies employed against them. For many years the Russian Government occupied only the coast of the Kuban on the Black Sea to cut off the Circassians from foreign aid, and it was not until 1864 that they were finally subdued, and the chief tribes north of the mountains were given the choice of moving into other less inaccessible lands or of emigrating into Turkey. In the east, in Daghestan, Kazi Mollah and his more famous

successor Shamyl, after 1824, kept up a desperate resistance, repeatedly escaping or defeating the expeditions sent against them, until the capture of Gunib and of Shamyl himself in 1859. From Turkey, Russia acquired by the Treaty of Adrianople the regions about the towns of Poti and Achalzig; by the Treaty of Berlin the seaport of Batum and the territory and fortress of Kars, though, owing to the opposition of England, she was obliged to retrocede the city of Bayezid, near Mt. Ararat, which had been surrendered to her at San Stefano. The province of Transcaucasia now has an area of ninety-four thousand square miles and a population of some eight millions and a half, unequalled, perhaps, in the world for variety of nationality and language.

On the other side of the Caspian, in the huge but thinly inhabited regions of central Asia, we find the greatest extension of Russia in the last century, and particularly in the latter half; for previous to the reign of Alexander II. she had done little but occupy a few bases of operations and send Perovski's unfortunate expedition against Khiva in 1839 and 1840. Even leaving out of consideration any ambition of the statesmen of St. Petersburg to push the borders of the Empire towards the open sea, or to occupy such a position on the flank of India as would force Great Britain to think twice before making trouble in other parts of the world, the conquest of Turkestan (as it used to be called) was inevitable, sooner or later. No civilised modern state submits in the long run to the neighbourhood of a jumble of barbarous principalities and tribes, unable and often unwilling to maintain order within their own boundaries or to prevent depredations beyond them. The Muscovite campaigns in central Asia may have been due to political schemes of the time or to the ambition of individuals, but at bottom they were brought about by perfectly natural causes, like the spread of British rule in India after it had once got a real

foothold. It is unnecessary here to do more than recapitulate the chief steps.

By 1864, Tchernaiev had conquered most of the region to the east of the Syr-Daria, or Jaxartes; in the following year he took Tashkend by storm; in 1868, Samarcand was annexed and the defeated Emir of Bukhara compelled to submit; in 1873, Kaufmann made his successful expedition against Khiva, which was reduced to a vassal state and the desert regions to the east and west of it were added to the Empire; in 1876, Khokand, having revolted against its Khan, was subdued and annexed. Up to this point Russian progress had been from the north, and much impeded by the huge desert stretches the troops had been obliged to traverse. Now, immediately after the last war with Turkey, which so nearly led to a conflict with England, we find the Russians starting from a new base of operations, their posts at the south-east of the Caspian, and pushing with more conscious purpose along a line just north of the Persian frontier, maintaining their communications and greatly strengthening their position by building the trans-Caspian railway behind them. In 1881, Skobelev took Geok Tepe by storm; two years later Merv surrendered without resistance; in 1885, Komarov defeated the Afghans at the Kooshk River; and the frontier marked out by the Anglo-Indian Delimitation Commission in the following year gave Russia the district of Penjdeh. Farther to the eastward, in the high mountains of the Pamir plateau, the meeting place of empires, a definite boundary which now brings the two mighty rivals into immediate, if almost inaccessible, contact was established in 1895. In Persia the conflict of influence between them has lasted for the greater part of the century, and still continues. At present, a treaty made a few months ago seems to put the government at Teheran financially in the hands of that of St. Petersburg, but as yet we cannot call Persia a part of the

dominions of Nicholas II. any more than we say Afghanistan belongs to Queen Victoria. On the other hand, Khiva and Bukhara (most maps to the contrary notwithstanding) are as much a portion of the Russian Empire as any native Indian state is of the British.

To the north-east of central Asia, Kooldja, in the valley of the upper waters of the Ili River, had fallen into a state of anarchy at the time of the great Dungan rebellion against China. Profiting by the confusion, as the district was on their side of the mountains and seemed only a natural geographical continuation of their own province of Semiretchinsk, the Russians occupied it and held it for ten years. The Chinese, however, having re-established their authority elsewhere, now demanded back Kooldja, to obtain which they appeared ready to go to war if necessary. As such a war would have been most unwelcome to the Government at St. Petersburg, it yielded after some negotiation, and gave up the greater part of the territory, though retaining the western portion.

Turning now to Siberia, we find that almost the whole of it has belonged to Russia since much earlier than the nineteenth century. Its recent history, therefore, has chiefly been one of internal development and of filling up with an immigrant population, for long very slowly, but with an ever-increasing rush in the last dozen years. The trans-Siberian railway, whose traffic is already far beyond the estimates, will greatly facilitate the development of the fresh sources of wealth of many kinds that are being discovered; and the annual immigration, in spite of a tendency on the part of the Government to restrict it, has risen to something like two hundred thousand people. What Siberia needed most was an outlet to the east, for the Treaty of Nerchinsk, in 1689, had cut off Russia for nearly two centuries from the lower valley of the Amur and any seacoast with a temperate climate. One man, Muraviev (appointed Governor of East Siberia in 1847),

acting on his own initiative and in spite of coldness and of some hostility on the part of his superiors, made a marvellous change in the situation. Trusting to the decay of Chinese strength and authority in these regions, he descended the Amur River and established on its banks a series of posts, including the factory of Nikolaievsk at the very mouth (1851); and finally, profiting by the Taiping rebellion, the troubles of China with England and France, and the general confusion and imbecility at Pekin, he signed, after six days' negotiation in 1858, the Treaty of Aigun, which, supplemented by that of Pekin two years later, gave Russia not only the whole northern bank of the Amur, but also the maritime province between its southern affluent, the Ussuri, and the sea, with the site of the present city of Vladivostok. The importance of these acquisitions can hardly be overestimated. Russia not only gained a rich territory of extreme value to the rest of Siberia, but her relations with the Chinese Empire were revolutionised, for she now has a position of vantage no other Power can hope to equal, as recent events have amply demonstrated.

We may note as a small later gain the part of the island of Saghalin held by the Japanese and ceded by them, in 1875, in return for the Kurile Islands, but we need not include in our account here the interference of Russia in the Chinese-Japanese war, her designs on Korea, her lease of Port Arthur and Talien-Wan, and her acquisition of partially sovereign rights in Manchuria. In none of these cases has there been definite, absolute cession of territory, though it practically amounts to this for the Liao-tung peninsula; still, in view of what is happening in China, we may treat these last events as mere preliminaries to a chapter of history belonging to the twentieth century. It is worth noting, however, that in her present attitude towards China, Russia seems to be partly actuated by the modern motives of commercialism, which

have hitherto played little rôle in her history, owing to her very recent industrial development.

In concluding our survey of the changes of boundaries of the Empire of the Czar, we must not forget that, on the American continent, not only did the attempt to found settlements near the Columbia River in 1809 and in California in 1812 lead to nothing, but, in 1867, Russia sold all her American possessions, amounting to over half a million square miles, to the United States for the small sum of $7,200,000.

When we try to sum up our impressions of a century of Russian expansion, the first glance at the figures should show us the error of the common Anglo-Saxon notion that we are dealing with a particularly rapacious Power, growing faster than any other. Counting up gains and losses, we find that the increase of Russian territory during the century has been far less than that of Great Britain, or of the United States, or even of France, and is hardly larger than the colonies acquired by Germany in the last fifteen years. Even as lately as a generation ago, the Russian Empire was double the size of the British; it is now the smaller of the two by over thirty per cent. Its great accession of strength has come chiefly from the natural growth of its population and the development of its resources. If it were suddenly reduced to-day to its frontiers of the year 1800, it would still be the second largest state in the world, with a population of over a hundred millions of inhabitants. What makes the power of Russia appear so imposing, and her advance so irresistible, is not so much the size of her armies and the skill and ambition of her statesmen, whose reputation has often been exaggerated; it is, rather, the compactness of her enormous mass, which gives her the same sort of practical invulnerability possessed by the United States. Whereas we can without much difficulty conceive of a war that would deprive

England or France or Germany of all their colonial possessions, and even mutilate their territories so that they would forfeit indefinitely the position of great world-powers which they now hold, such a disaster is almost inconceivable of Russia. She might be beaten by a coalition, and exhausted, as she was by the Crimean War; she might lose Finland, Poland, her territories south of the Caucasus; none of these would affect her vitally, and even the taking away of her coast on the Pacific might check, but could not prevent the development of Siberia, and would be difficult to maintain in the end. However the extremities might suffer, the great national bulk of the Empire would remain little harmed, and would need but a few years' rest to begin to expand again along natural lines. No wonder that the progress of Russia has been likened to that of a glacier. This progress, like that of every conquering empire, has been marked by much that is unjustifiable, but though perhaps there has been more Eastern crookedness in her methods than in those of some other countries, on the score of rapacity or the desire to extend the benefits of civilisation, — call it what you will,— no one of the great nations of the world can afford to throw stones at the others. The Anglo-Saxon finds it difficult to sympathise with Muscovite ideals of government, and is often loud in his denunciation of the practices of the Russians; but he must admit that, with the possible exception of Finland and Poland, all the regions which have passed under their rule in this century have found it, whatever its faults, unquestionably superior to anything they had before known. To-day Russia is one of the leading Powers in the world, and, as far as human foresight extends, she seems destined to remain so.

CANADA IN THE NINETEENTH CENTURY

By Sir John G. Bourinot

At the commencement of the nineteenth century the total population of the five provinces of Prince Edward Island, Nova Scotia, New Brunswick, Lower Canada, and Upper Canada did not reach 270,000 souls, of whom at least 150,000 were French Canadians. Their total trade did not exceed $10,000,000, the public revenues were inadequate for the public requirements, and the British Government was obliged to give considerable aid to the provincial Treasuries. The government was directly controlled by the Imperial Secretary of State in London and his representatives in the several provinces. The governing authorities in the five provinces were these: A Governor-General in Lower Canada,— then the most populous section of British North America,— who exercised a nominal supervision, as the royal representative, over all British North America; a Lieutenant-Governor in each of the other four provinces; an Executive Council in Upper and Lower Canada, generally composed of members of the Legislative Council; a Legislative Council in all the provinces, appointed by the Crown, and in Nova Scotia, New Brunswick, and Prince Edward Island exercising executive as well as legislative functions; an Assembly, elected by voters possessing a small property qualification, in all the five provinces.

The Imperial Government had certainly the interests of British America at heart, but nevertheless they erected a structure of provincial government which was defective

at its very foundation. The Crown was supreme in the executive and legislative councils, and the Assembly had little influence over the administration of public affairs. The absence of a system of local or municipal institutions in the provinces was another serious weakness in the provincial machinery. The people were called upon to manage the affairs of a province before they had learned to administer their purely local affairs in city, township, or village. Despite these defects, inherent in the system of government, the machinery worked with little friction for a while. The unfortunate war of 1812–15, in which Canada performed her duty to the Empire with infinite patriotism, prevented political dissension, since all classes of people recognised the supreme necessity of uniting at this crisis to defend their homes and country. The war did much to solidify the various racial elements of British North America during its formative stage. Frenchmen, Englishmen, Scotsmen from the Lowlands and the Highlands, Irishmen, and Americans, one and all, united to support British connection. But when peace was proclaimed, and the Legislatures were relieved from the pressure that the war had brought upon them, the politicians again got the upper hand. The machinery of government became clogged, and political strife convulsed the country from one end to the other. An " irrepressible conflict " arose between the Government and the governed classes.

In all the provinces, but especially in Lower Canada, the people saw their representatives practically ignored by the governing body, their money expended without the authority of the Legislature, and the country ruled by irresponsible officials. A system which gave little or no weight to public opinion as represented in the Assembly was necessarily imperfect and unstable; and the natural result was a frequent deadlock between the Legislative Council, controlled by the official class, and

the House, elected by the people. The Governors necessarily took the side of the men whom they had themselves appointed and with whom they were acting. This system of government was generally worked in direct contravention to the principle of responsibility to the majority in the popular House. Political agitators had abundant opportunities for exciting popular passion. In Lower Canada, Papineau—an eloquent but impulsive man, having rather the qualities of an agitator than those of a statesman — led the majority of his compatriots. For years he contended for a Legislative Council elected by the people; for it is curious to note that none of the men who were at the head of the popular party in Lower Canada ever recognised the fact, as did their contemporaries in Upper Canada, that difficulties would be best solved, not by electing an upper house, but by obtaining an executive which would hold office only while supported by a majority of the representatives in the Assembly. In Upper Canada the radical section of the Liberal party was led by Mr. W. Lyon Mackenzie, who fought vigorously against what was generally known as the "Family Compact," which occupied all the public offices and controlled the government.

In the two provinces these two men at last precipitated a rebellion, in which blood was shed and much property was destroyed, but which never reached any very extensive proportions. In the maritime provinces, where the public grievances were of less magnitude, the people showed no sympathy with the rebellious elements of the upper provinces, and eventually obtained an enlargement of political freedom by strictly constitutional agitation.

Such was the political situation in Canada when Queen Victoria ascended the throne on June 20, 1837. If we survey the general condition of things in those troublous times, the prospect was not encouraging. The total

population of the provinces did not exceed 1,350,000 souls, of whom nearly one half were French Canadians. Trade and commerce were quite paralysed by the political discontent which had existed for years, and had already broken out into rebellion. The value of the whole trade of British North America — that is, of the imports and exports — was about twenty-five million dollars. The revenue of all the provinces did not exceed seven million dollars, and in more than one province — notably in Upper Canada — it was insufficient to meet the ordinary expenditures. The total production of wheat did not exceed five million bushels, of which the greater portion was raised in French Canada, despite the want of energy and knowledge displayed by the habitants in the cultivation of the soil. The seigniorial exactions — a heritage from the French *régime* — retarded settlement and enterprise in the province of Lower Canada. The excessive grants of land made by the Crown to the Loyalists, to military men, and to the Anglican Church, kept valuable districts of Upper Canada idle and profitless for years. The little island of Prince Edward had been nearly all granted by ballot to a few landlords in a single day, and until the entrance of the colony into the Confederation in 1873, its progress was seriously crippled by the difficulties arising out of this wholesale disposal of the public domain. The means of communication in each province were most wretched, in the absence of a municipal system and local taxation, and as a result of the ownership of large districts by absentee proprietors. The only town of importance was Montreal, with a population of forty thousand souls. Few streets in the cities were lit or paved, and buildings of architectural beauty were the exception. Denominational colleges existed for the higher education of youth, but the state had not in any degree intervened successfully in the establishment of a system of popular

elementary schools. In 1838, there was in all the public and private schools of British North America only one fifteenth out of a total population of a million and a half of persons. The administration of justice was satisfactory in all the provinces except in Lower Canada, where justice was sadly clogged by national jealousies, which showed themselves constantly in the jury box. As in the courts of law and in the Legislature of French Canada, so it was in social and every-day life—the French Canadian in direct antagonism to the English Canadian. "I expected," wrote Lord Durham in 1839, "to find a contest between a government and a people; I found two nations warring in the bosom of a single state; I found a struggle not of principles, but of races."

The special mission of Lord Durham, who was sent to Canada as Governor-General in 1838, was a turning-point in the political development of the British North American colonies. As a sequence of his report, so replete with political wisdom, English statesmen of all parties, notably Lord John Russell, recognised at last the necessity of intrusting a larger measure of self-government to the people of the provinces—of giving them as complete control of their internal affairs as was compatible with the security of the Empire.

The union of the Canadas in 1841, when the French and English sections were equally represented in one Legislature, was the first important step in the political development of all the provinces of British North America. Then followed, between 1841 and 1849, the concession of responsible government in the fullest sense of the term, while the Legislature obtained control of the provincial revenues and taxes. At the same time came the repeal of the Navigation Laws which had fettered colonial trade since the days of Cromwell. The Post-office was given to the Canadian Government, and in fact all matters that could be considered to appertain to

the provinces were placed under their immediate legislative jurisdiction. The Canadians, under the impulse of a relatively unfettered action, went vigorously to work to lay the foundations of a municipal system, as indispensable to the operations of local self-government. The troublesome land question, involved in the seigniorial tenure, was settled after much agitation on terms favourable to vested interests, while the clergy reserves were also arranged so as no longer to favour one Church at the expense of others, or to impede the progress of settlement and cultivation. The union of the Canadas lasted until 1867, when it had outgrown its usefulness, and the provinces found it necessary to enter into a federation, which had been foreshadowed by Lord Durham and advocated by many eminent men even before his time.

The Confederation of 1867 brought only four provinces into one territorial organisation for general or Dominion purposes — Ontario, Quebec, Nova Scotia, and New Brunswick — and it was not until 1873 that little Prince Edward Island, the garden of the Gulf of St. Lawrence, united its political fortunes with those of the young Dominion. Efforts were made to bring in Newfoundland, but purely selfish local considerations have always prevailed in that island over national sentiment, and it is still doubtful when this large colony, which has been placed by nature as a sentinel at the very portals of Canada, will fall into line with its sister colonies in North America. One of the most important results of confederation in its early days was the annexation by the Dominion of that vast tract of country which up to that time had been almost exclusively in possession of the Indians and the traders of the Hudson Bay Company. Next came into confederation the province of British Columbia, which extends from the Rockies to the waters of the Pacific Ocean. A new province of Manitoba, watered by the Red and Assiniboine Rivers, and territorial districts as

large as European states, were organised for purposes of government in the vast prairies of the West. Within a period of thirty years Canada has stretched from the Atlantic to the Pacific, and the territory now under her control is very little inferior in extent to that of the great republic to the south, and contains within itself all the elements of a prosperous future. It is, unhappily, true that this result was not achieved until blood had been shed and much money expended in crushing the rebellious half-breeds led by the reckless Riel; but, apart from this sad feature of Canadian history, this important acquisition of territory has been attained under circumstances highly advantageous to the Dominion. Canada now possesses an immense territory of varied resources—the maritime provinces with their coal, fish, and shipping, together with a valuable, if limited, agricultural area, not yet fully developed; the large province of Quebec, with ranges of mountains on whose slopes, when denuded of their rich timber, may graze thousands of cattle and sheep, with valuable tracts of meadow lands, capable of raising the best cereals, and the finest cattle of the continent; the rich province of Ontario, the chief agricultural section of the Dominion, whose cities and towns are full of busy industries; the vast North-west, still in the very infancy of its development, destined to give the Confederation several provinces outside of Manitoba, as large and productive as Minnesota, and to be the principal wheat-growing district of Canada; and, finally, the gold-producing province of British Columbia, whose mountains are still rich with undeveloped treasures, and whose mild climate invites a considerable industrious population to cultivate its slopes and plateaus and to collect the riches of its river and deep-sea fisheries. Even that inhospitable Arctic region of the far North-west of Canada, through which the Yukon and its tributaries flow, appears to be rich with untold treasures of gold and other minerals,

and promises to be a source of wealth to a country which is still in the infancy of its material development.

The majority of the Canadian people are as yet confined to the old Acadian and Canadian provinces which stretch from the Gulf of St. Lawrence to the head of Lake Superior. Still, within thirty years, a considerable population has flowed into the North-west, and the capital of Manitoba is now an enterprising, prosperous city, with probably 50,000 people. The population of the Dominion has increased twenty times since 1800, and consequently numbers about 5,400,000, of whom thirty per cent. are French Canadians. The total annual trade of imports and exports now realises $375,000,000, an increase of $365,000,000 in a hundred years. The revenue has reached $51,000,000, mainly made up of customs and excise duties. The people have deposited in government savings banks nearly $70,000,000, apart from the large amounts deposited in the chartered banks, loan companies, and building societies. More than 17,000 miles of railway are in operation from the Atlantic to the Pacific Ocean. Upwards of $400,000,000 are invested in cotton, woollen, wooden, and other manufactures, while at the present time American capital is creating in the town of Sydney, in conjunction with the rich bituminous coal mines of Cape Breton, one of the largest iron industries of the continent. The shipping industry is very active, and fourteen lines of steamers call regularly at Montreal, which has a total population of nearly 400,000, and must always be the commercial metropolis of the Confederation.

The people of the Dominion are well provided with facilities for every grade of education. The universities —notably those in Montreal and Toronto — stand deservedly high in the opinion of men of learning in the Old World and in the United States, while the grammar- and common-school system in the English-speaking provinces

is creditable to the keen sagacity and public spirit of the people. We have already seen the low condition of education sixty years ago,—only one in fifteen at school, — but now there are more than a million of pupils in the educational institutions of the country, or one in five, at a cost to the people of upwards of $10,000,000, contributed for the most part by the taxpayers of the different municipalities in connection with which the educational system is worked out. In French Canada there is an essentially literary activity, which has produced poets and historians —Ferland, Garneau, Crémazie, Fréchette—whose works have naturally attracted attention in France, where the people are still deeply interested in the material and intellectual development of their old colony. The successes of English writers have been chiefly won in scientific and constitutional literature, especially by Dr. Todd and Sir William Dawson. The seventeen handsome volumes published in as many years by the Royal Society of Canada—established by the present Duke of Argyll when Governor-General—give evidence of the intellectual activity of the best minds of the French- and English-speaking peoples. Bliss Carman, Charles G. D. Roberts, Wilfrid Campbell, Frederick George Scott, Duncan Campbell Scott, Archibald Lampman, W. H. Drummond, and Ethelwyn Wetherald merit a high place in the roll of American poets. Gilbert Parker has at last made Canadian romance popular on two continents. *Sam Slick the Clockmaker*, and other books by Judge Haliburton, a Nova Scotian, are still the only noteworthy evidences we have of the existence of humour among a practical people, and his "Wise Saws and Sayings" were uttered more than sixty years ago. In art we have L. R. O'Brien, George Reid, John Hammond, Homer Watson, Robert Harris, J. W. L. Forster, W. Brymner, and Miss Bell, who have done much meritorious work.

Self-government now exists in the fullest sense of the

term throughout the Dominion, as the result of the political struggles of a hundred years. At the base of the political structure lie those municipal institutions which enable a people in every local division to make improvements, support schools, and even encourage public libraries. Then we go up higher to the provincial organisations, governed by a Lieutenant-Governor, nominated and removable by the Government of the Dominion, and advised by a Council responsible to the people's representatives; with a Legislature composed, in only two of the provinces, of two Houses,—a Council appointed by the Crown and an elective Assembly,—while in all the other provinces there is simply an Assembly, chosen by the people either by universal suffrage or on a very liberal franchise. The fundamental law known as the British North America Act, which was passed by the imperial Parliament in 1867, gives jurisdiction to the provincial governments over education, provincial works, hospitals, asylums, and jails, administration of justice (except in criminal matters), municipal and all other purely local affairs. In the territories not yet constituted into provinces there is provided an efficient machinery, in the shape of a Lieutenant-Governor, appointed by the Dominion Government; of an Advisory Council to assist the Lieutenant-Governor, and of a small legislative body of one house, elected by the people, which has the power of passing, within certain defined limits, such ordinances as are necessary for the good government and security of the still sparsely settled countries under its jurisdiction. These territories are now represented in the two Houses of the Dominion Parliament. Their representatives have all the rights and privileges of members of the organised provinces.

The general government of the Dominion is administered by a Governor-General, with the assistance of a Ministry responsible to a Parliament composed of a Senate

of seventy-eight members, appointed by the Crown, and a House of Commons of 213 members, elected by universal suffrage in nearly all the provinces. This government has jurisdiction over trade and commerce, post-office, militia and defence, navigation and shipping, fisheries, railways, and public works of a Dominion character, and all other matters of general or national import. The appointment of a Governor-General by the Crown, the power of disallowing bills which may interfere with imperial statutes and treaties, the right which Canadians still enjoy of appealing to the Judicial Committee of the Privy Council from the courts of the provinces, as well as from the Supreme Court of Canada; the obligation which rests upon England to assist the colony in time of danger by all the power of her army and fleet, the fact that all treaties with foreign Powers must necessarily be negotiated through the imperial authorities — these are the most patent evidences of Canada being still a dependency of the Empire. Even the restraint imposed upon Canada with respect to treaties has been modified to a great degree by the fact that England has acknowledged for thirty years that Canada should be not only consulted in every particular, but actually represented in all negotiations that may be carried on with foreign Powers affecting her commercial or territorial interests.

One of the most encouraging results of this political system has been not merely the material development of the Dominion, but the creation of that powerful national sentiment which best enables the whole political structure to resist successfully any storms of racial antagonism or passionate partyism which may from time to time beat against its walls. French Canada, with its population of more than a million and a quarter of people, still maintaining their language and special institutions, is no longer restive and uncertain of its future as in the years preceding and following the rebellion. It is true that at

times, when the French Canadians press their national prejudices to extremes, a spirit of antagonism is at once evoked between them and the English classes, but the unfortunate state of things that existed before 1837 is no longer likely to return, and whatever jealousies or rivalries break out now and then above the surface are sooner or later carried away by a current of a sound public opinion, anxious for the harmony of all classes and creeds, and only solicitous for the safe working of the Union.

The next great step in the political career of Canada is a question which frequently occurs to imperial as well as to Canadian statesmen. It is not annexation to the United States—that is impossible; it is not independence —that is not even discussed under existing conditions. These are days of a dominant imperialism throughout the British Empire, and the influence of that sentiment in Canada can be estimated from the enthusiasm with which Canadians have rallied to the aid of England in South Africa. One thing is quite certain, that the national movement among all British-speaking people—indeed, among all such thoughtful French Canadians as Sir Wilfrid Laurier—is towards the placing of the relations between the parent state and its great dependencies on such a permanent basis as will strengthen the Empire and give Canada even greater influence in the councils of the imperial state.

MEXICO

By Charles F. Lummis

ALTHOUGH, with the sole exception of the United States, no other country in the western hemisphere has been so organically renovated, remodelled, and replaced, since the death of Washington, for Mexico the nineteenth century might almost as well have begun in its last quarter, so far as modernisation goes. The decades antecedent were picturesque, instructive, thrilling, doubtless preparatory, but by any present-day standard of development they count chiefly as showing what Mexico did *not* have before the Plan of Tuxtepec. The seventy-six years had been not of logical (if slow) accretion, concretion, and amelioration, but the rawest, bloodiest, and most wasteful apprenticeship—a harder service, and less to show for it, than any other modern nation can offer. Yet, perhaps, they were not wholly in vain. No one, certainly, can soberly study them and then the Mexico of to-day, and ever again talk glibly of the unfitness of any people for self-government.

In 1800, Mexico was the very apodixis of colonialism; a type we shall never see again, whether for its splendour or its consistency. Never more was any nation to be able to hold colonies without some apology to the moral sense of civilisation — some plea in mitigation. The mother of the colonial system held colonies because she wished to, because she could, and because she was short-sighted enough to fancy they paid. And she begged no one's pardon. Mexico was her paragon, the richest, the

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

most profitable, the most consummate colony in history. It had outstripped Peru, its only rival. Its viceroyal capital was not only the greatest, wealthiest, and most magnificent city in the New World,—it outranked Madrid. It was the apotheosis not only of the colonial, but of the protective system. A plum for Spanish politicians and Spanish merchants, why divide it with heretics? Trade followed the flag,—but no alien need tag after the procession. Mexico had no relations with the world—there *was* no world, except Spain. All other peoples were *ex-officio* enemies. No foreign vessel could enter a Mexican port. No foreigner could own mines or lands. The religious, political, social, economic, and personal destinies of New Spain were administered from Old Spain with a logical absolutism for which "mediæval" is a loose word; yet with so much conscientiousness and humanity and wisdom as, perhaps, imperialism has not since shown. For Mexico had "good government," as we venture to use the word now. Spain kept her American colonies contented and loyal about twice as long as England did hers. And for fifty years after the "Independencia" of 1821, life and property were never again so safe in Mexico, nor scholarship so alert, nor development so normal, as they were under the worst viceroy of the sixty-two who had administered the colony for Spain through two hundred and eighty years.

The last of the really great viceroys—Revillagigedo—had been gone for four years when the century opened. The *Vireinato* had entered upon its last chapter and anticlimax—the puttering ten viceroys who could have been spared, mostly mediocre men at best, and at best hobbled by the sudden powerlessness of Spain and by the sudden change of temper in the colony, where the virus of our Revolutionary example was already working, at first insensibly, but inevitably.

The century was already ten years wasted when the

" Grito " of independence was raised prematurely from the church-tower of an obscure mountain hamlet. It is significant that the " Washington of Mexico " was a priest,—as was the next highest hero of the eleven years' war for freedom,—and, still more so, that the betrayed Hidalgo was turned over to the Inquisition to be executed. The Holy Office did not die in Mexico until the colonial system did.

And when, after more than a decade of struggle, brutal enough on both sides, Spain was defeated by a nation not of seventy-six, but of six millions of people, Mexico had not won good government nor really self-government. The regency slid easily into the pinchbeck empire of the turncoat Iturbide. In 1823, his yearling throne gave way to the provisional government of Bravo; and, in 1824, the federal republic was born — with nearly a quarter of the century gone, not one serious advancement in civilisation made, and scant visible hope of its making, by this peevish, cantankerous, and *raquítico* infant. The Church was still supreme, and now confirmed in its monopoly by the first Constitution. Foreign relations were non-existent. Domestic trade and relations were more than Chinese; and society was feudal as ever. As for politics, they were, for the first time in Mexican history, a wide-open scramble for the spoils.

More than half a century of usurpation, revolution, and chaos followed. The country averaged more than one new government a year. Counting regencies, emperors, presidents, triumvirates, dictators, and other rulers, the " republic " had as many administrations in sixty years as the colony had had viceroys in two hundred and eighty years; and more uprisings in one year than the colony had ever had. It is hardly worth while to analyse national progress during the pitiless obsession of pretenders. Some beneficent measures were enacted in lulls of the perennial storm; to be enforced, for the most part, a

generation or two later. Besides its two empires, the country has had two Federal Constitutions — both modelled after that of the United States, as all Spanish-American constitutions are. The Supreme Court, established in 1824, has been several times reconstructed, twice or thrice suspended, and now dates from 1857. A crude educational system was enacted in 1833, but it was nearly half a century before Mexico began to have a modern public-school system worthy the name. National conditions prior to the last quarter-century may be well enough inferred from even a cursory list of the most important policies for the first time adopted or enforced since that pregnant epoch began. For a few examples: So late as 1870, postage was twenty-five cents per quarter-ounce up to sixty miles, double for a greater distance; now Mexico is in the Postal Union, and has an admirable service as cheap as ours. The first official atlas was made in 1851. The Bureau of Statistics dates from 1882, and the first real census of the republic was made in 1895 —giving a population of twelve and a half millions. Revillagigedo's census of 1793 gave less than four and a half millions. Habeas corpus was introduced in 1861, and made adequate in 1882. The first naturalisation law was passed in 1886. It requires two years' residence. Immigration, as a means of grace, was first recognised in 1883. Vaccination was made compulsory in 1872. Ten years ago Mexico established a patent system. In 1877, the first meteorological observatory was founded. Now there are twenty-two observatories. The metric system was adopted in 1857, and made compulsory in 1896. The dollar became the money unit in 1861. In 1876, Mexico began (at the Philadelphia Centennial) as an exhibitor in foreign expositions, and ever since has been an interesting figure in them.

The phlegmatic, narrow, hard-headed Zapotec Indian, Benito Juarez, was the very first *domador* whom this

pitching bronco of a republic could not throw. He was no graceful rider. The caballeresque aptitudes were all beyond him. He was not *simpático*, nor tactful, nor foreseeing. He could not captivate, nor even conciliate. But he could sit on,—and he did sit on; dark, dogged, inscrutable. He even knew no better than to repudiate what foreign debt the nation had been able to acquire; and thus brought down upon his head England, France, and Spain, in the bloodiest and most perilous war Mexico has known. But neither revolutions nor the intervention itself could unhorse him; and after fourteen years in the office he died, still President. I have often wondered whether even the *Reforma*, for which he is best known, did so great a service to his bedevilled country as did his casual demonstration that it was possible for a Mexican President to hold on. It was the very first object-lesson in stability — behind which must come all other national problems.

Be that as it may, this Old Hickory of Oaxaca bulled through the first sweeping measure for the defeudalising of Mexico—the breaking up of the church monopoly. He did it as ungently, as unwisely, and as unjustly as could have been expected. It was a knot for the greatest statesmen, both as to the moral equities and the political expediencies,—and this rude Indian simply chopped it off; paying several needless wars for his tactlessness. The disestablishment, in Mexico, was little more than a national burglary in the name of freedom. But it was a tremendous aperient. More judicial times shall undo the worst brutalities of it; but the *Reforma* broke, at one clumsy, vindictive blow, the ecclesiastic monopoly which in three and a half centuries had so vastly stimulated and so vastly paralysed Mexico. So late as 1860, half the capital city was owned by the Church.

Juarez confiscated everything — churches, convents, asylums, academies. The bankrupt nation was thus

cheaply supplied with school-buildings, prisons, and other utilities, and a beggar's dole of funds,—by selling the temples for residences, stables, and heresy, at from one to twenty per cent. of their value. The swing of the *Reforma* may perhaps be guessed by the sample fact that a Protestant mission to " convert " Catholics bought for $4000 the temple of San Francisco, which cost about as many hundred thousand.

Yet when Juarez died (1872) Mexico seemed no more unified, no more established, no more bridle-wise. The only path to power was still by revolution. Juarez had outlived but not uprooted anarchy. His successor, Lerdo de Tejada, did neither. He fled the country in November, 1876, unable to face the last successful—and perhaps the first beneficent — revolution in Mexican history.

Porfirio Diaz, already for a decade confessed the greatest soldier of Mexico, and suspected of being the least selfish, became provisional President the same month, and constitutional President in sequence. Except during the consented interregnum of Gonzales (1880–84), he has been President ever since. Modern Mexico dates from and with him; the knell of feudalism sounded in his Plan of Tuxtepec, January 16, 1876. He was first patentee in Mexico of peace and voluntary stability. As steady in the saddle as Juarez, he was incomparably more at ease there. A stronger and more supple hand, as deathless a will, a vastly deeper and finer intellect, and a personality as winning as it is dominant have made him not master only, but idol of his disrupted country. Since he first laid hand upon the rein, the land, where for fifty years revolutions were recurrent as the seasons, has not had an uprising which in the slightest degree menaced the stability of the Administration. It probably will not have again. The country which had had four foreign wars in fifty years (counting the French " pie claim " of

'38) has had no more, nor is likely to have. It is no longer an easy bait for conquest; and it is actively engaged in giving good government to Mexico instead of to its weaker neighbours. The first step of this usurping soldier was to reduce the army—twenty per cent. at the first cut. The nation grows larger, the army smaller. In 1888, the Mexican army numbered 33,238 men; in 1896, Diaz had reduced it to 8659. And in the same time he had perfected the most competent country police force in America, the *Guardias Rurales.* In ten years, the traveller on the remotest trail in the vast wildernesses of Mexico was safe; the unparalleled brigandage of half a century was extirpated.

After peace, progress. As the Spanish proverb has it: "He comes not late who comes." And, if late, Mexico has come. One hardly knows whether to marvel more at the length of time the republic went without the garb of modernity, or the swiftness with which she has donned it. Save for an antiquated treaty with England in 1826, —abrogated with the Intervention, and dead for more than twenty years,— the richest country in the world for over three hundred years, and the second republic in America ever since 1821, began relations with the outer world only in 1883, by a treaty with the North German Confederation; in 1885, with Norway and Sweden; in 1888, with France; in 1889, with Great Britain (renewed); Japan in the same year; Ecuador in 1890,— and so on. Her treaty with the United States (negotiated by General Grant and William H. Prescott) dates from 1884. Two years earlier, Mexico had successfully vindicated her boundary line as against our authorities, who had the happy habit of violating it on almost any sort of an errand; and, in the same year, settled her still older embroilment with Guatemala over Chiapas.

In 1854 the first Mexican railroad was finished — from the city to Guadalupe, three miles; also twelve miles

of the Vera Cruz line; then no more till 1861. The Vera Cruz road (263 miles) was finished in 1873. The country was "again" railroads,—fearing the "peaceful invasion" which was so much a watchword with American promoters. But Diaz, against the counsels of even so enlightened a patriot as Matias Romero, gave $120,000,000 in subsidies to railroads. To-day there are over 7500 miles of railroads in the republic; and he is responsible for ninety-five per cent. of them. He admitted that railways must some time come into Mexico, anyhow; but he felt that in the psychologic moment when the nation was nerved for its first sober stride into modernity, it was "business" to pay them to come at once. He was wise beyond that which is written. Railroads not only promoted commerce,—they smothered revolution. A backwoods *revolucionario* could no longer "pronounce" and drill his levies for a month or so before the Government even heard of him.

With railroads, commerce came up almost like a jack-in-the-box. Before, the normal freight rate from Vera Cruz to the city, 263 miles, had been 26 cents per ton per mile; and at times it went up to $1.25. That meant, of course, imports limited to luxuries for the wealthy; exports limited to gold, silver, indigo, and a few other articles precious by the ounce. Railroads, with tariffs regulated by Government, opened, for the first time in Mexican history, the marvellous productivity of Mexico. In 1826, the imports of Mexico were $19,000,000, the exports $14,000,000. In 1896, imports were $42,000,000, exports $105,000,000. When Diaz came in, the United States supplied about one fourth of the imports of Mexico; now it supplies one half. It took $12,000,000 out of Mexico's $29,000,000 of exports; and in 1895–96 it took over $79,000,000 out of $105,000,000. The first Mexican telegraph line was built in 1851; now there are 28,000 miles of lines.

Within my memory, exchange from one Mexican city to another—and not necessarily far—was often up to ten per cent., so arduous and dangerous were the roads. The first national bank in Mexico was established in 1882. For more than nine tenths of the century the barbarous interstate and intertown taxes had maintained their feudal throttling of progress,—though for thirty years the commonest and fiercest slogan of every campaign had been, "Down with the Alcabalas!" It was only in 1896 that the most impetuous of Mexican soldiers and most patient of Mexican statesmen dared repeal them. I saw the Alcabalas die, unwept, unhonoured, and unsung. A longer article than this would be required to analyse what the abolition of this immemorial trade gag-law meant for commerce, manufacture, and even communication and national unity.

The whole financiering of Mexico in the quarter-century has been, perhaps, without parallel. Credit the nation had none. Poverty, insecurity, and repudiation had done their perfect work. Every year the Government faced a deficit. Taxes were grievous,—and nothing to show for them. In 1885, the deficit was $35,000,000. In 1896, a surplus came along,—and to stay. Diaz had at once reduced taxes and begun unheard-of public improvements. Peculation was stopped. Accounts began to be kept exactly. I know no other country in America where the whole public service is so free from "politics" and spoils as in Mexico to-day. Our own country is not in the comparison at all. Mexican credit is now at par. In his first decade Diaz raised it from ninth to second place among the Spanish-American nations. The national debt is about $203,000,000.

There was education in the colonial days,—and admirable in its ecclesiastical sort. But the Mexican public-school system is due to Diaz. There are now over 7500 free public schools in Mexico, or one to every 1600

population. There is not in the republic a village of 100 Indians which has not this benefit. And there are over 2000 private and religious schools besides, and liberal provision of technical, normal, professional, and other higher institutions. The higher education is as free to women as to men. Compulsory education began in 1896. The National Library of 200,000 volumes (ravished from the Church) was opened in 1884. There are now 102 other public libraries in the country.

Before Diaz, Mexico had one fit harbour — the second best in the world, but cut off by one hundred leagues of dangerous and difficult mule-path. Now Vera Cruz has been made an adequate harbour by an outlay of $20,000,000, and Tampico as expensively added to the list, while Acapulco, the only great natural harbour in 5000 miles of Pacific coast, is now being fetched into reach by one of the Diaz railroads.

In its first half-century, the republic did not have one public work of even half the calibre to give it place in a compend of this span; not a public building, not a reform in financial, social, commercial, educational, administrative, municipal, or other reform in any serious category. Its one large—though mixed—achievement had been the unhorsing of the Church. To-day there are over six hundred Protestant congregations in Mexico, striving to convert not pagans, but Christians, and, in fact, harvesting their sort of proselytes. But Mexico does not object, our contributors to " missions " do not, and no more do I. Yet the matter is significant. Such tolerance of an impertinence no other nation ever comparably endured is a long way from the Inquisition which martyred Hidalgo. So is it that a wholly Catholic nation does not permit a priest to walk the street in his robes, exiles the Sisters of Charity, suppresses religious processions, and forbids prayer as part of the programme of any national celebration.

Before Diaz, the rich and ancient capital had spent two and a half centuries and ten millions in vain attempts to relieve its recurrent floods. Sewerage was unknown. To-day the valley is drained and sewered by a system nowhere surpassed. Electric lighting, transit, and power-transmission are in vogue. Law and order are of a proportion we may well envy. Public education and individual scholarship have no call to blush in a fair comparison with any land. Business is prosperous, almost without individual exceptions. Factories of all sorts—and some of the costliest and finest factories in the world—have sprung up by the thousand. The comminuted bones of a national spirit are knit as they never were before. Nowadays, it is not Mexico, but we, who are "fooled" when we omit her from the category of the nations that count. She does count; she will count far more. She has mastered anarchy, she has triumphed even over free silver. She is busily engaged in practising one of the first gospels and mottoes of the American colonies, —"Mind Your Own Business,"—and is making a magnificent success at it. It is a curious problem in the philosophies of history, what shall be the outcome of a nation which, instead of being born rugged and growing old and lazy, was born old and in the last quarter-century has come into the heritage of sturdy youth. For it is as a young nation, with muscles still growing, that we must think of new Old Mexico.

THE CENTURY'S CHANGES IN CHINA AND JAPAN

By W. E. Griffis

At the opening of the nineteenth century, Orientals and Occidentals were profoundly ignorant, indeed almost unconscious, of each other. Each wrote "the history of the world," leaving out one half of it. Japan, Korea, and Siam were hermit nations, and fiercely inhospitable. China, surrounded on all sides by deserts, plateaus, or jungles, was accessible only at Canton. The idea prevailed in the West that the "Celestial" Empire was a land of mystery and of sages, and that her satellite nations were hopelessly recluse. In American atlases a map of one of our own States or subdivisions occupied a whole page, the other countries or continents in the world getting a fraction, while at the end of the book all Asia figured in puny proportions. One could cover China with a teacup, the whole Empire with a small saucer, Japan with a caterpillar, and Korea with a mouse's ear. A Chinese atlas, none the less successful in distorting reality, gave a page to a province, and then dumped all the rest of the world on the last sheet. In Chinese view, all the civilised people dwelt in the Middle Flowery Kingdom. Those outside were "barbarians," their countries being but tassels upon the imperial robe.

Few in the West cared to know who was Emperor of China or Tycoon of Japan,—the Mikado being then too ethereal and shadowy even to be thought of. To the far Oriental, the politics of Europe were lunar; to the

European, those of China were subterranean. Except to get its trade and taels, who cared for the land of Confucius? Popularly, Chinese Asia was supposed to be inhabited entirely by "Mongolians," all dressing and looking alike, and eating the same food, in which rats figured as the chief dainty. The illustrations in our text-books and even authentic books of travel, as they emerged from the average artist and wood-engraver, showed woful monotony of human features in man and in landscape. If Chinese letters or figures were introduced, they were almost sure to be upside down. On the other hand, it cut directly across the grain and growth of age-long tradition in China to imagine the presence of aliens on the soil for any purpose except to bring tribute. The British envoy, Lord McCartney, sailed up the Pei-ho River to the capital, thinking he was being honoured with all possible graciousness of imperial favour. He little suspected, until enlightened, that the great staring characters on the sides of his boats and heaped-up presents read, "Barbarian tribute-bearers coming to do homage to his Majesty, the Chinese Emperor."

Broadly speaking, all Chinese Asia, embracing one third of the population of the globe, had one common stock of ideas. In their forms of expression, in art, literature, language, religion, laws, government, and social customs, the dominant note is that of impersonality. "God" or "Heaven" represents bundles of laws or principles. The idea of man as individual, self-conscious, and free is extremely feeble. Tradition and precedent are holy. The ancients had all the wisdom. Originality is a deadly sin. Individuality and personality are to be suppressed. The glory and dignity of man as man are next to unknown. The family, clan, or horde is everything. "The Soul of the Far East," in the Western view, is no soul at all—hardly better than its Japanese symbol, a crystal ball. Impermanence is

the law of the world, and unconsciousness the goal of life.

Dependent not only for intellectual, religious, and social, but also political ideas and models, the surrounding pupil nations looked up to China as novices to a master. In Chinese orthodoxy, the Emperor is the Son of Heaven. All divine rights had been given to him. He ruled his people as Heaven's regent, as a sun in a system wherein the outlying nations were but satellites. This doctrine of Whang Ti runs all through Chinese political literature and has tinged, and tinges, every document that issues from Pekin. Even if Japan, long the irregular and uncertain member of the system, though accepting the Chinese calendar,—symbol of sovereignty,—failed to own obedience, the " face " of the doctrine was saved by quoting alleged precedents, for China is a country ruled out of the graveyard rather than according to fact and need.

Before any true progress, any real transformation of the hermit nations of the East could begin, this doctrine must be shattered. While China enforced it, the nations dependent upon her could not rise in self-consciousness. Japan led the way by first, in 1868, giving her own Son of Heaven the reality of sovereignty, rejecting the Pekin calendar, customs, and legislation, and adopting international law and the codes of Christendom. This was easy enough, for she flung away what she had but borrowed. It is not so easy for China to cast away her own. In China, the difference in relative stability between political and social systems compels a contrast as of rock and wave. Whether we begin the story of China in the fog of legend and mythology, before the tenth, or with actual history in the eighth, century B.C., we are struck with her great number of dynasties. Of these, we count over thirty, while during various prolonged periods of misrule and civil war there were many contemporaneous

lines of Sons of Heaven, often hostile and rival. Five have been Tartar dynasties. This means that the Chinese people have been again and again conquered by barbarians from the north,— Manchuria, Mongolia, and even regions farther to the west. The last winners of the dragon throne enforced the wearing of the pigtail queue.

Nevertheless, each conqueror has himself submitted to conquest. Every flood of arms, every river of new religion, each wave of innovation, science, or philosophy, has in turn emptied itself into that oceanic social system which is the solvent of everything in China, and, like the ocean itself, apparently as unchangeable. From this point of view, Japan seems antipodal in its contrast with China. Her rock is a dynasty. Her social system has been repeatedly changed. Her political developments have been many. Japan, with a genius for assimilation, is the champion borrower of the world. Wonderful evolutions have characterised her popular religion, but her one line of emperors, beginning fifteen hundred years ago, has been ever the same. One reason for this is patent. The Japanese are not, like the Chinese, an old race. They emerged into history contemporaneously with the Teutonic peoples. What they tell of themselves before the fifth century is a delightful fairy tale, but worthless as history. They are a mixed race, a composite people. Out of that great drift of humanity, floating up on the Kuro Shiwo, or Black Tide, from the tropic islands, out of remnants of tribes driven, it may be, from India, out of the repeated migrations from Tartary and Korea, out of Nigrito, Aino, and Tartar stocks, has emerged the Japanese composite,—"the diamond edition of humanity." A predominant house arising in the south-west was able to force its neighbours into vassalage. By a system of theology (which Shinto, literally translated, means), as well as by skill in war, craft in

government, and a rude fedual system, the inhabitants of the main island were united under the sway of the impersonal Awful Gate, or Mikado. Adopting Chinese culture and a centralised government, the Japanese were able, especially under the tutelage of the Buddhist missionaries, to make a true nation. Under priestly influences the Mikados became monks, shadows of power. All this time there was being evolved that striking figure, the flower of Japanese manhood, the Samurai, or servant of the Emperor, gentleman, scholar, warrior,— a type of man the like of which no other nation in Asia possesses. Even now, after all changes, he, as the heir of a thousand years of culture, persists as the maker and ruler of new Japan. After the military rule of the Middle Ages had degenerated into anarchy and chronic civil war, three great " beginners of a better time," Nobunaga, Taiko, and Iyéyasu, prepared the way for national unity. When consolidated, Japan thrust out the European priests and traders. The native Christians were ruthlessly exterminated — as was thought. Then the duarchy and perfected feudal system of Iyéyasu held all Japan fixed until the middle of the nineteenth century.

Thus looked at from within, in the seventy-second " Cycle of Cathay," A.D. 1801, it must have seemed to the average man of culture in Chinese Asia as if society and systems were fixed, philosophy perfect, and the forces of cohesion invincible. Indeed, the poetry and other literature of " the three countries " are full of this idea. Commentaries on Confucius, or on his commentators, philosophy founded on the stereotyped numerical categories of heaven and earth, and romances looking always to the past were the rule. Religion was wholly preterite or pessimistic. In political economy the purpose was not only to exclude all foreign elements, but also to shut up the people within a narrow circle of ideas. Population was kept stationary by rigid laws and licensed

sensualism. Child murder by exposure, drowning, or violence kept the food demand from overpressing the soil. Despite the storage of grain in fruitful years, local famines were frequent. Witchcraft and superstition, often cruel and murderous, shadowed life, and in places kept it often just above the suicide point. The old literature of reform had but one view—a perpetual looking backward. In Japan a reformer customarily wrote out his views and then committed hara-kiri.

Yet there were causes at work for the making of a new order of things. In the native religions, indeed, we discern no revolutionary, or even novel, principle powerful enough to revitalise "the three nations." And this, notwithstanding that the history of sects shows constant attempts at betterment. The favourite scheme was, by eclecticism or fusion, to make Confucianism, Buddhism, Taoism, or Shintoism work in harmony to produce hopeful results. Yet although those schemes were many, it cannot be said that anything noteworthy was produced. It was the religion of the West which furnished in each country the fertilising principle of a new national growth, or at least gave the link of connection with the Occident. In China, Catholic missionaries had entered with ideals which need not particularly disturb native society, except in the matter of the worship of ancestors. Politically, indeed, the germ of differences, which might break out in war, because so closely allied with the ambitions of France to champion all Christians in the East, lurked in the demands of the foreign priests that their converts should be protected. Yet the Roman order and doctrine were not necessarily inimical to Chinese literary, artistic, or social dogmas. These missions might have been in China a thousand years without acting as a ferment to destroy the organic structure of the Chinese world.

It was wholly different, however, when the agent of reformed Christianity came, with his printing-press to

disseminate everywhere scientific information, with his inquiries, with his healthy scepticism against antiquity, with his challenge of art and literature, his determination that the whole low-lying structure of morals, philosophy, and religion should be lifted up. He began at once to translate the most radical of all books, and thus to build a railroad through the national intellect. No higher compliment could the " yellow press " of America pay this sort of teacher than to say that the pitifully small body of two thousand or fewer missionaries (among four hundred millions) caused primarily the great uprising in China of 1900 A.D. Mohammedanism, though disturbing to the minds of orthodox Confucianists and to the Chinese social system, was as nothing compared to the uprooting, and also the upbuilding, systems and methods by which the scientific and religious tracts and books were sent all over China.

There have been many minor causes working for the destruction of the Chinese world. The Mohammedan and various other rebellions, including the Tai-Ping (which latter demonstrated that under Western leaders an invincible soldiery could be formed out of China's millions), the rejection by Japan of Confucian ideals, and the consequent disturbing influence on other nations of her example, the liberalising of mind arising from foreign trade and contact with foreigners, the pressure on China's borders of aggressive Western nations, were all potent forces. Yet these would never have wrought mental transformation or made " foreigners " of natives. They all seem utterly inferior to the one undermining influence of teachers whose ideas were revolutionary to the official system, which is as the jointed steel framework upholding the Chinese edifice. Their multifarious agencies, instead of modifying the life of a few native adherents here and there, did a far more radical and transforming work within the native cranium. They made the Chinese see,

think, and question. They filled him with the spirit of improvement and desire for innovation. Centuries ago the development of China was arrested for lack of vision and loss of mental initiative. The teachers, the healers, the traders of the West brought the contagion of both. Most horrifying to the mandarin, they made the native a "foreigner Chinaman," for he at once longed for social intercourse with his fellows. What literati, office-holders, "Boxers," and others who raise the cry, "Drive out the alien," fear most, is not commerce, not missionaries, not opium, but reform. They know their day is over when China becomes social. China's only hope is in that large and influential party of reform which, whether composed of Christians, non-Christians, or anti-Christians, is the direct creation of the foreign educator.

Chinese statesmen have ever seen in Japan the uncertain and treacherous member of the Confucian system and "the land of dreadful heresies," political, social, and religious. In these islands the seeds left in the sixteenth century by Portuguese missionaries were, in spite of censorship, persecution, and bloody repression, still charged with vitality. Shinto sects absorbed the Christian ideas, and in 1868 it was the presence of the native Christians that gave cause for one of the very first activities of the new imperial Cabinet and for foreign pressure. The former, by reissuing edicts of persecution, drew forth from Europe the clear notification that, so long as the Japanese oppressed man for conscience' sake they could receive no recognition as civilised people. This acted immediately and powerfully in dictating Japan's domestic policy and her whole attitude towards Western civilisation. Apart from the question of the influences from without,—foreign commerce, diplomacy, science and literature, military and naval conflicts, which have not wholly, but only partially, been the causes of the transformation of the Orient during the past hundred years,—

it is well to know who were the leaders in native ideas and action.

In the history of royalty in the far East we find few names of personal importance. It is not merely that those of Kai King, Tao Kwang, and Hien Feng mean nothing to the Occidental. Even in Chinese history they are but shadows. So likewise of Japanese mikados by the score. It was rather the exception in Chinese Asia that the sovereign, or indeed any of those who held high rank and title, were of any personal importance. The real directors of affairs, who managed the puppets on the throne and governed the people, were able men of inferior rank. These let others have the shadow and glitter, while they turned the keys. In "the three countries" the men of letters were the men of power; but whereas in China the pen and the sword were separate, and the soldier and the scholar naturally antagonistic, in Japan they were never separated. Thus there grew up in Japan a class of men unique in Asia. The Samurai, or soldier-gentleman, during the last three centuries at least, has been equally at home in letters and in arms. Before A.D. 1600, the priest served as the soldier's secretary and mentor; but it was in the scheme of Iyéyasu to make all his retainers able to write as well as to fight. Soldier that he was, he set the powerful example of gathering books and manuscripts and of establishing schools. Despite all the divisive effects of Japanese feudalism, which lasted until 1870, a large body of educated people, trained in codes of honour and high ideals, was thus unconsciously prepared to absorb the culture of the West when this came to them in the forms of commerce, invention, science, and ethics.

It would be a great mistake to suppose that the Japanese are mere imitators, or have simply borrowed the tools and appliances of the West. In reality, Japan never was, in spite of all attempts to make her so, a hermit nation.

During all the times of her isolation, the loophole of communication with Europe through Holland was kept open. For two centuries and a half there flowed in steadily a constant stream of information, ideas, and books, until, at last, even before the nineteenth century, the study of the Dutch language was begun. This brought to students the scientific, and especially the medical, knowledge of Europe. Nagasaki became the goal of hundreds of inquiring spirits, and these, returning to their isolated homes, made centres of light and inspiration. The nation at large was slowly leavened and made ready for transformation. Perry's fleet, in 1853, had to be surrounded by a cordon of boats, less to keep in the foreigner than to keep back and out the native seeker after the secrets of Western power. The interior history of Japan, as of the catacombs, shows a line of martyrs for the sake of knowledge. If a row of Japanese biographies standing on the writer's shelves, printed since 1880, were put into English, the story would be one of thrilling detail. To-day many fair monuments rise over the ashes of men whose books were once seized and destroyed, while their bodies languished in prison for publishing knowledge then supposed to be dangerous. The fact to be noted is that Japan, unlike Korea or China, had a large body of educated men prepared for the changes which our century demanded.

The Japanese have attained to unity, national consciousness, and even recognition of equality among the nations of the world. The chief causes were the study of their own native language, literature, and history; the revival of pure Shinto, the presence of the Dutch, and, above all, the coming of alien teachers and healers. "Beautiful new Japan came from over the sea," said one whom the Mikado decorated and buried, and to whom the Japanese themselves reared a statue. Yet the methods used differed from those in China. In all the

disturbances and violence, between 1860 and 1870, there were no outbursts of mobs or uprisings of the people at large. Every act which broke the peace was of individual initiative and execution by Samurai. Yet no history of the time, worthy of the name, could leave out the work of the American missionaries in teaching and healing, and in the training of the young men who were leaders in reform. One, especially, Guido F. Verbeck, from 1859 to 1868 taught scores of young men in the constitutions of the United States and of the European states, and in their law, as well as in the New Testament, his pupils becoming Cabinet Ministers and filling scores of important offices. When called to Tokio by his former pupils to advise them in multifarious courses of action, he elaborated a system of national education, organised and personally directed their university, dictated the language in which medical science should be expressed, proposed and planned in detail the great embassy of 1874, persuaded them to abandon persecution, assisted them for many years by advice and in the translation of the world's great documents in law and government, and urged them to secure unity by the formation of a national army and navy. Furthermore, Japan changed her capital, gave up the ridiculous mystery-play of a sedentary Son of Heaven hidden behind screens, made him walk out in public, cut off at one stroke her hereditary pension list of two millions, made office dependent on ability, and threw open the army, navy, courts, schools, commerce, and the professions to all. Thus, a so-called hermit nation accomplished regeneration from within. Although there were naval actions which tended powerfully to open the eyes of brave but narrow-minded patriots, yet Japan was never invaded by a foreign army. During their many humiliations, through long-postponed justice in diplomacy, the Japanese gave themselves all the more seriously to the mastery of constitutional government

and of modern problems. Hence Japan is now the teacher of Asian nations and the leader in their transformation.

The Chinese, on the other hand, although they saw, as Japan did, object lessons in Western civilisation at the treaty ports, could not, even if their great area and vast numbers had permitted, respond to Western civilisation in the way in which Japan did. In China, the people hated their foreign dynasty, and the civilian despised the soldier. The educated, encrusted with their pride and traditions of culture, were impervious to innovation. The literati who held the monopoly of office saw only too clearly that reform meant their undoing. Being so vast, so ancient, with all the diseases and infirmities likely to inhere in old age, China had no such unity or even sensitiveness as her insular neighbour. Although to our eyes it seems as if a great army of foreign merchants, missionaries, and diplomatists had long dwelt in China, yet until 1850 the whole body of alien men, women, and children did not probably number five thousand; down to 1895 there were no more than ten thousand alien residents, and these almost wholly on the seacoast. Millions of Chinese have never seen a foreigner. Hence the awakening of China has had to come through the slow process of leaven by means of foreign book and tract, school and college, the influences of trade, and occasional wars, in which only the seacoast or the capital suffered. No real penetration of the actual China proper has yet been made. The facilities of the lettered class for concealing and distorting the actual facts, even of imperial humiliation, are beyond any censorship ever conceived. The people at large never really know what is going on. Nor does there appear any deep desire on the part of the Occidental to know the Chinese people thoroughly. In home and club such a desire is too often ridiculed, while in our schools and universities, who studies Chinese or

Japanese ? Our ignorance of the people whose trade we hope to win is disgraceful. Is it any wonder that native and alien do not see eye to eye ? There are those who think "the yellow brain" abnormal, the Chinese a puzzle, the land a mystery. Yet those who are closest to the people in real fraternity and altruistic labour believe the Chinaman to be a normal man, capable of absorbing all the highest influences. They are one in their faith that China is yet to take her place in the sisterhood of nations and mightily influence for good the world at large.

SOCIOLOGY

GEOGRAPHICAL CONQUESTS OF THE NINETEENTH CENTURY

By Louis Heilprin

THE third century after the discovery of America drew to its close with a veil of darkness still shrouding half the globe from the eye of civilised man. A Strabo or a Ptolemy, if questioned in 1800 as to how much of the earth's surface he could describe with accuracy, would have had to confess that he was quite familiar with only one of the grand divisions, and that one embracing only a tithe of the land of our planet. He might perhaps have claimed that he could make a tolerable map of South America, whose interior had been partly opened up by the zeal of the Jesuit missionaries. It would, however, have been full of great voids, representing regions unknown to him. He would have been able also to construct a map of Asia, approximately reproducing its main features, but his outlines would have been merely the frameworks of blurred and empty pictures. The Himalayas had not been measured — the Andes figuring as the highest mountains on the globe. There was a boundless area within the Chinese Empire untrodden by Europeans. In Asiatic Turkey, Persia, and in Afghanistan, in Turkestan, and the Pamir, there were whole regions removed from the ken of cartographers. Scant information existed regarding Japan, Farther India, and the Malay Archipelago; next to nothing was known about Korea, and the interior of Arabia was almost a blank. Australia was still floating as a cloud on the horizon. Most of the

lands north of America had not yet been discovered, and the Antarctic realm had barely been touched.

The accurate knowledge of Africa was limited in the main to a narrow strip along the coast. As for the interior, comprising about one fifth of the earth's land surface, geographical learning had hardly begun to outgrow its mediæval estate. Cartographers had been groping their way amid the confused reports of traders, slave dealers, and missionaries. The feature of equatorial Africa regarding which the most correct conjecture had obtained for centuries, was the source of the Nile, which river, in accordance with the teachings of Ptolemy and the old Arab geographers, was represented on the maps as issuing from some lakes in the heart of the continent, fed by the Mountains of the Moon. Geographers knew of a great river that flowed by Timbuktu, the Queen of the Desert, and which they called the Niger, a name handed down from the time of the ancients. It had long been supposed that this stream had a westerly course and that the Senegal and Gambia formed its delta. A counter theory was that it flowed eastward to a large lake, a view based in part upon vague reports about Lake Tchad. Still another theory regarded the Niger as one of the great arms of the Nile. The Congo was known only in the last portion of its interminable course, although as far back as the seventeenth century the opinion had been entertained that it issued from the same quarter of the continent as the Nile. The Sahara remained untravelled by Europeans, except near its margin, and the great lakes of Africa were known only through tradition or vague report.

In North America, the region between the Mississippi and the Pacific and north of New Mexico still belonged in great part to the realm of fancy. We read in the first American edition of Guthrie's *New System of Modern Geography* (Philadelphia, 1795): "In North America,

which is chiefly composed of gentle ascents, or level plains, we know of no considerable mountains, except those towards the pole, and that long ridge which runs through the American States, and which is called the Appalachian or Alleghany Mountains." British America remained in great part unexplored, and the coast of Alaska had barely been grazed. There were whole regions, like the Adirondack wilderness, included within the bounds of the original States of the American Union, which were still sealed to geographers.

Nearly three hundred years after the tracing of the coast line of Africa was completed by the voyages of the Portuguese, the systematic exploration of the interior may be said to have commenced in 1788 with the foundation in London of the African Association, an event which inaugurated a new era in the history of geographical discovery. This society had the good fortune to command almost at the start the services of the intrepid Scotchman, Mungo Park. Before this, it is true, the pioneer of modern African exploration, Sir James Bruce, had made his memorable journey along the Blue Nile, and the ornithologist, Le Vaillant, had travelled in the hunting-grounds of South Africa. Just before we hear of Mungo Park, the record of discovery also tells of a narrow wedge driven towards the heart of the continent in the journey of Browne from Assuan to Darfur. The African Association assumed for one of its first tasks the unravelling of the mystery of the Niger. The journeys of Mungo Park (who perished in the stream in 1806), of Clapperton and Denham, and of Lander, covering together the period from 1795 to 1830, revealed the course of the river. The French, meanwhile, explored the Senegal and Gambia. At this time English explorers began to push from the Guinea coast into the warlike kingdoms of Ashanti and Dahomey. In 1826 the ill-fated Laing, and in 1828 Caillié, succeeded in reaching

Timbuktu, that mysterious seat of Islamism which had for centuries fascinated geographers.

The close of the eighteenth century was the beginning of a new era in the annals of American exploration. The travels of Alexander von Humboldt, between 1799 and 1804, in the basins of the Orinoco and Magdalena, and in the Andes and Mexican Cordilleras, mark an epoch in the history of geography and natural science. His work was taken up and extended to other regions, especially Brazil, by eminent naturalists like Maximilian of Wied, Spix, Martius, Auguste de Sainte-Hilaire, Orbigny, and Pöppig. These had worthy successors in the brothers Schomburgk (British Guiana), Darwin (Patagonia, Tierra del Fuego), Avé-Lallemant (Brazil), Tschudi (Andes, Brazil), Castelnau (Brazil, Bolivia, Peru), and Burmeister (Brazil, Argentina).

By the acquisition of the Louisiana territory in 1803 the United States came into possession of a boundless domain, in great part as far removed from the knowledge of white men as the heart of Africa. An exploring expedition was immediately sent into this *terra incognita* under Lewis and Clark, who proceeded up the valley of the Missouri, crossed the divide of the Rocky Mountains, and followed the Columbia down to the sea. The explorations of Pike, Long, Ponneville, Catlin, Nicollet, and Frémont, the opening of overland routes to Utah and California, and the Government survey for a Pacific railway made deep rifts in the trans-Mississippi region; but its greatest wonders were to remain enshrouded until the tide of colonisation had begun to sweep over the whole area. It was not until 1832 that the Mississippi River was traced to its source by Schoolcraft.

The exploration of the Arctic regions, in the hope of finding a northern water route for the trade with the East, had lost much of its fascination by the eighteenth century. Russia alone prosecuted it systematically in

the course of that century, accomplishing a great work in tracing the coast line of Siberia. About the beginning of the nineteenth century the idea of a North-west Passage was revived in England, and the dream of reaching the pole began to be entertained. A great and persistent onslaught upon the frozen North was inaugurated in 1818. The labyrinth of islands, peninsulas, and ice-bound passages north of the American continent yielded up its intricacies to the assaults of Parry, the two Rosses, Sir John Franklin (to whose tragic end Arctic discovery owed much of its rapid progress), McClure, Kane, McClintock, and Hayes. The exploration of Arctic British America was prosecuted on land with heroic energy by Franklin, Back, Richardson, Beechey, Dease, Simpson, and Rae. Parry, in an attempt to reach the pole in 1827, dragged his sledges over the floating ice-fields to the parallel of 82 degrees 45 minutes, eclipsing all previous records by more than a degree of latitude. In 1831, James Clark Ross solved the mystery of the position of the north magnetic pole, which he located in the peninsula of Boothia.. McClure entered the Arctic Ocean through Bering Strait in 1850, proceeded eastward, was beset for years in the ice, joined hands in 1854 with an expedition which had come in the opposite direction, and thus carried off the laurels of the North-west Passage. While a great breach was being made in the Arctic fastnesses, Bellingshausen, Weddell, Dumont d'Urville, Sir J. C. Ross, Wilkes, and others extended geographical discovery into the Antarctic regions. Ross discovered Victoria Land, with its active volcanoes, and, in 1842, advanced beyond the seventy-eighth parallel. During this same period the cruel depths of Australia, whose coast had been explored by Flinders in 1801–03, were invaded by Sturt, Eyre, and the ill-fated Leichhardt.

A flood of light was thrown upon the geography of

Northern and Central Asia in the first half of the nineteenth century by the journeys of Ermann, Humboldt, Middendorf, Huc (who entered Lhassa, the holy city of Tibet), and others; while men like Webb, Moorcroft, and Wood scaled the heights of the Himalayas and the Pamir, and reached the head streams of the Indus, Ganges, and Amu Daria. From 1848, Mt. Everest, with the 29,002 feet given to it by the trigonometrical measurement of Sir Andrew Waugh, figured as the highest point on the globe. Among the naturalists who were attracted to the Himalayas, the name of the botanist Hooker stands pre-eminent. The most distinguished traveller in South-western Asia in the early part of the century was Burckhardt, who succeeded in entering the holy places of Mecca and Medina. In 1829, Ararat was ascended by Parrot. In 1832–33, Alexander Burnes performed his famous ride from India to Bokhara. The travels of Crawfurd and MacLeod in the second quarter of the century dispelled in part the obscurity hanging over Farther India. Between 1835 and 1849, the naturalist Junghuhn explored Java and parts of Sumatra. Among his successors in the Malay Archipelago were St. John and Wallace.

Down to the time of the French Revolution, Europe had hardly dared to cast a covetuous eye upon the interior of Africa. Portugal, England, and France held sway at a few stations along the coast. The sturdy Boers, near the Cape of Good Hope, alone represented actual colonisation by Europeans. The Revolution brought in its train Bonaparte's conquest of Egypt, the first great onslaught upon African territory on the part of Christendom in modern times. The consequences of the French domination, brief as it was, were far-reaching in the loosening of Turkey's hold upon that country. Another result of the wars of the Revolution was the supplanting of Dutch dominion at the Cape by that of

England. An army of ardent missionaries now made their way into the interior of South Africa. While England was laying the foundations of an empire at this end of Africa, France suddenly invaded the north and conquered Algeria (1830–48). A few years before this invasion, Mehemet Ali, Viceroy of Egypt, brought Nubia and Kordofan under his sway. This ambitious potentate, who, for the first time since the days of Saladin, made the aggressive power of Africa felt in another continent, in his rôle of moderniser of Egypt, sent various scientific expeditions to explore the Nile, which was now traced almost to the equator. To this period of African exploration belong the travels of Rüppell, the brothers Abbadie, Beke, and Krapf in Abyssinia.

With the middle of the nineteenth century commences an extraordinary era in the history of geographical discovery. The world begins to close in upon the dark interior of Africa, which is assailed on every side, and in the course of a generation the great features of the continent are unfolded almost in their entirety. In 1847, the German missionaries Krapf and Rebmann discovered the snow-capped peaks of Kilimanjaro and Kenia, near the equator. In 1849, Livingstone discovered Lake Ngami, in the heart of South Africa, at a distance of a thousand miles from Cape Town. In the course of the next seven years he extended his explorations to the upper Zambesi, of which mighty stream hardly anything had hitherto been known, followed it up, struck out westward along the edge of the Congo basin (a circumstance unknown to him), made his way to the Portuguese possessions on the Atlantic, then, turning back, followed the Zambesi down-stream, discovered the Victoria Falls, the rival of Niagara, and reached the shores of the Indian Ocean. While Livingstone was drawing a luminous trail across South Africa from sea to sea, Heinrich Barth was lifting the veil from the depths of the continent on the

other side of the equator by his extraordinary journeys in the western half of the Sudan. In the sixth and seventh decades of the century large accessions were made to the knowledge of the Nile basin and the surrounding regions, including Abyssinia, by the travels of Petherick (who explored the basin of the Bahr-el-Gazal), Munzinger, Beurmann, Heuglin, and others. In the meanwhile, the French were pushing into West Africa on the side of Senegambia, Du Chaillu travelled in the country back of the Gabun and through the wilds of the Ogowe, the home of the gorilla and the pygmy Obongo; Burton scaled the Peak of Kamerun, and Von der Decken explored what is now British East Africa.

Just as Barth was emerging from the scorching suns of Central Africa, laden with the knowledge of countless peoples, in another continent three equally intrepid Germans proceeded to explore the most elevated region of the globe. The brothers Schlagintweit crossed the Himalayas and the Karakorum, traversed the lofty plateau of Tibet, and surmounted the Kuenlun, reaching heights to which no traveller had ever climbed.

Soon after Livingstone's traverse of South Africa, the beginning was made of those discoveries which unravelled the most interesting problem presented by the geography of that continent. In 1858, Burton and Speke, despatched by the Royal Geographical Society, in quest of a great reservoir of fresh water which was believed to exist somewhere in the region whence the Nile issued, discovered Lake Tanganyika. Before the close of that year, Speke discovered a still larger lake, the Ukerewe, or Victoria N'yanza, which he assumed to be a reservoir of the Nile, although as yet its outlet remained to be found. To what river system, if any, Lake Tanganyika belonged was a problem which was to wait still many years for a final solution. In 1859, Livingstone came to the shores of a third great lake, the Nyassa, a feeder of the

Zambesi. Within the next five years the question of the sources of the Nile was approximately settled by the explorations of Speke, Grant, and Baker. The last named, ascending the river from Egypt, in 1864 discovered the lowest of the Nile reservoirs, the Mwutan Nzige, or Albert N'yanza. What Ptolemy had laid down on his famous map seventeen hundred years before was found to be substantially correct, and the discovery later on of snow-clad mountains near the Albert N'yanza, culminating in Ruwenzori, substantiated what the Greek had taught regarding the Mountains of the Moon.

The problem of the Nile was closely interwoven with that of the Congo, the greatest mystery that still confronted geographers outside of those presented by the polar regions. The Nile question, indeed, could not be regarded as completely settled until the watershed between the two rivers had been determined. Of the Congo basin, equal in extent to that of the Mississippi, but a mere fraction was known to the world. A boundless maze of tropical forests and rivers had thus far escaped the eye of Europeans. Geographers were not even agreed as to whether the Congo issued from the heart of the continent, or whether it was not rather in the nature of a coast river. Livingstone applied himself with heroic resolution to the task of ascertaining the parting of the waters that found their way to the Mediterranean and those that flowed toward the Atlantic. In 1867–68, he discovered the Luapula, the eastern head stream of the Congo, and its two large reservoirs, Mweru and Bangweolo, and in 1871, stood on the banks of the great river that hurries past Nyangwe, but not possessed of the information that would assure him beyond doubt that it could be no other than the Congo.

During these years wide explorations were made in Central Africa, north of the equator, by Rohlfs, Nachtigal, and Schweinfurth. Nachtigal, a worthy successor

of Heinrich Barth, succeeded in making his way into Wadai, a Mohammedan state in the Sudan, a goal the pursuit of which had cost the lives of two eminent explorers, Vogel (1856) and Buermann (1863). Schweinfurth penetrated into the cannibal regions west of the equatorial Nile, and, in 1871, came to the Welle, whose westward course convinced him that he had travelled beyond the bounds of the Nile basin.

These journeys were coincident with a remarkable epoch in the geographical annals of America. The explorations of Dall revealed the extent of the Yukon; the mountain systems of the West were explored by Wheeler, Whitney, and Hayden; Powell discovered the grand cañon of the Colorado; Washburne and Hayden made known the marvels of the Yellowstone. The knowledge of British America was at this time greatly extended by the travels of Bell, Selwyn, Dawson, and others. Simultaneously with the exploration of the mountains of North America, the geological structure of the Andes was laid bare by Reiss and Stübel, who ascended the volcano of Cotopaxi to its summit.

While the rest of the world was engaged in prying open the recesses of the continents, the Russians were displaying extraordinary activity in the exploration of their vast Asiatic domain and the regions bordering on it. In the first fifteen years of the reign of Alexander II., Semyenov, Valikhanov, Radlov, Ostensacken, Syevertsov, Fedtchenko, and Kaulbars assailed that mighty mountain barrier, composed of the Altai, Alatau, Tian-Shan, Alai Tagh, and the Pamir, which shuts off the elevated desert region of Central Asia from the plains of Western Turkestan and Siberia. During the same period Shishmarev, Mattussovski, and Pavlinov penetrated into Mongolia, and Palladius into Manchuria. The Russian advance into the Central Asiatic highlands met with a prompt response from beyond the Himalayas, whence

Hayward, Shaw, and Forsyth pushed into Eastern Turkestan, while the pundit Nain Singh made a memorable traverse of Tibet.

When Japan and China, soon after the middle of the nineteenth century, opened their portals to the world, the work of exploration, previously inaugurated by dauntless missionaries and naturalists, proceeded with a new impetus. Great journeys were made in China by Blakiston, Pumpelly, Ney, Elias, Bastian, Cooper, and Richthofen, who belongs to the foremost rank of Asiatic explorers. In the decade beginning with 1861, explorations were made in the Caucasus by Radde, in Northern Arabia by Palgrave, and in Turkestan by Vámbéry and Lagrée, and Garnier traced the course of the Mekong as far up as the Chinese province of Yunnan. Contemporaneous with these travels were the remarkable journeys performed in Australia by Burke and Wills, MacKinlay, Stuart, and Forrest, whose exploits were emulated by Giles and Warburton.

The year 1871 is memorable in the history of geographical discovery for the dramatic episode of the finding of Livingstone by Stanley. The meeting by the waters of Tanganyika was followed by the exploration of the northern end of the lake, which was found to have no outlet in that direction. Livingstone then returned to the scene of his recent labours, the Luapula-Lualaba basin. On May 1, 1873, he expired on the shores of Lake Bangweolo, which he had discovered, and which he had become convinced belonged to the Congo system. In 1874, Cameron discovered that Lake Tanganyika was connected by an outlet, the sluggish Lukuga, with the river formed by the Lualaba and Luapula. This river (which Livingstone had reached in 1871 at Nyangwe) was found by Cameron to flow at too low a level to admit of its belonging to the Nile system. This fearless traveller was prevented by the hostility of the natives from

descending the stream and verifying his belief that it was the Congo. It was reserved for the dauntless spirit of Stanley to bring the mightiest of African rivers within the ken of mankind. In November, 1876, he embarked at Nyangwe in a fleet of canoes, and, performing an unprecedented voyage, which twice carried him across the equator, he reached the tides of the Atlantic in August, 1877. And now came the great task of exploring the Congo tributaries, which enlisted the energies of Stanley, Capello and Ivens, Buchner, Pogge, Wissman, Grenfell, Wolf, Brückner, and Van Gèle.

While the veil was being lifted in this quarter, new light was thrown upon the regions west of the upper Nile by the travels of Junker, Casati, Gessi, and Lupton, the country between the Ukerewe and the coast was opened up by Fischer, Thomson, and Johnston, the naturalist Emil Holub travelled in the Zambesi region, and the explorations of Brazza between the Ogowe and the Congo laid the foundations of a new French colony. Between 1878 and 1881, Serpa Pinto made his traverse of South Africa, Oskar Lenz performed a journey from Tangier to Timbuktu and thence to the Senegal, and Matteuci crossed from Egypt to the Gulf of Guinea. At this time began the extraordinary career of Emin Bey (Eduard Schnitzer), administrator, explorer, naturalist, and linguist, in the region of the equatorial Nile. This heroic commander, the peer of the great Gordon, was cut off for years from the world by the Mahdist uprising, until at last Stanley succeded in reaching him by way of the Congo and Aruwimi, an exploit which recalled the days of the *Conquistadores* In 1887, the Rudolf Lake was discovered by Teleki. In 1889, Meyer reached the summit of Kilimanjaro.

During the years which revealed the sources of Africa's greatest rivers the exploration of the mighty tributaries of the Amazon was prosecuted by Chandless. A little

later Crevaux won laurels in the same field, and to him succeeded Karl von den Steinen and Ehrenreich.

The decade which witnessed the solution of the Congo problem, the last great mystery that had remained hanging over the equatorial zone, was marked by renewed activity in Arctic research. The passage leading north from Baffin Bay, beginning with Smith Sound, appeared to promise access to an open polar sea, the theory of whose existence had been put forth by Kane. The American expedition under Captain Hall in 1871 proceeded up this channel, and the splendidly equipped British expedition under Sir George Nares in 1875 followed in its wake; but Kane's theory was not verified. Some of Nares's men in 1876 reached the parallel of 83 degrees 20 minutes, eclipsing Parry's record by more than half a degree. Lieutenant Lockwood of the ill-starred Greely scientific mission in 1883 made a farther gain of four minutes. In 1873, the Austrian expedition of Weyprecht and Payer discovered Franz-Josef Land. In 1878–79, Nordenskiöld immortalised himself by accomplishing the North-east Passage.

While Stanley and his successors were opening up the exuberant forest realm of equatorial Africa, the arid expanse of Central Asia, stretching from the Pamir on the west to the highlands of Manchuria on the east, and embracing the desert of Gobi (Shamo), the Tarim basin, with the Takla Makan desert, and the ranges of the Tian-Shan, Kuenlun, Altyn Tagh, and Nan-Shan, was attracting the most intrepid explorers from all parts of the world. This illustrious roll includes the great Przhevalski (whose name is borne by the former town of Karakol, in Turkestan, where he died in 1888); Sosnovski, Mushketov, Kostyenko, Potanin, Regel, the pundit Krishna (who removed the long-existing doubt regarding the identity of the Sanpo and Brahmaputra), Pyevtsov, Bell, Bogdanovitch, Roborovski, Carey, the

brothers Grum-Grzhimailo, Rockhill, Younghusband, Bonvalot, and Henry of Orleans. These had distinguished successors in the last decade of the century in Dutreuil de Rhins (murdered by the Tibetans in 1894), Littledale, the young Swedish geologist Sven Hedin, Obrutchev, Futterer, Holderer, and Deasy. Among the host of ardent explorers who have travelled in China since 1875 are Sosnovski, Baber, Gill, Széchényi (son of the great Hungarian patriot, Count Stephen Széchényi), Kreitner, Easton, Hosie, Colquhoun, Henry, and Younghusband. It is only since 1880 that the geography of Korea has emerged from its obscurity.

In the last quarter of the nineteenth century the dimensions of the unknown in Alaska, the North-west Territories, and Labrador were vastly reduced by the explorations of Muir, Allen, Schwatka, Dawson, Ogilvie, Russell, Low, and others. In 1888, the first crossing of Greenland's great ice-cap (in its southern part) was accomplished by Nansen. In 1892, Peary and Astrup made a sledge journey of more than a thousand miles over the northern end, and determined the extension of the island in that direction. In 1893–95, the gap between the North Pole and the highest latitude ever before reached (Lockwood's 83 degrees 24 minutes in 1883) was bridged almost half over by Nansen's drift voyage and sledge journey, which carried him to the parallel of 86 degrees 14 minutes. This record was eclipsed in 1900 by the expedition of the Duke of the Abruzzi, which reached 86 degrees 33 minutes. The results of these expeditions render it improbable that any extensive land-mass remains undiscovered within the Arctic Circle. As the physical conditions prevailing at the North Pole cannot be materially different from those observed in the near vicinity, the reaching of the pole itself may now be regarded as a goal belonging to the realm of adventure rather than to that of scientific discovery.

In the same year in which Peary and Astrup crossed the fathomless ice-cap of Greenland the gigantic glaciers of the Karakorum were explored by Sir William Martin Conway, who climbed to an elevation of about 23,000 feet, eclipsing the record of all former travellers. In 1897, Aconcagua, probably the loftiest peak of the Andes, was scaled to its summit by Zurbriggen, the Swiss guide, and Vines, the geologist of Fitzgerald's expedition, the elevation obtained for it by barometric measurement being 23,080 feet. In 1898, Conway accomplished the ascent of Illimani, one of the rivals of Aconcagua.

At the close of the nineteenth century the attention of the world was once more turned, after a long interval, to the Antarctic regions. The British expedition under Borchgrevink succeeded in locating the south magnetic pole, and attained to the parallel of 78 degrees 50 minutes, surpassing by 40 minutes the "farthest south" achieved by Ross in 1842. Within the Antarctic Circle remains by far the greatest unknown area on the globe. Outside of the polar realms the physical map of our planet, barring minor details, is nearly complete. When the nineteenth century opened geographical science had half a world to conquer. At its close this conquest may be said to be well-nigh achieved.

THE GOLD STANDARD AND GOLD PRODUCTION IN THE NINETEENTH CENTURY

By Horace White

THE metal gold occupies a unique place among the substances of which the earth is composed. It is accepted by mankind without compulsion and without limit in exchange for all other kinds of property and for all the services that men render to each other for hire. It is the standard of value. It is a commodity the market for which cannot be glutted. For these reasons it is an object of universal desire. As a mineral it is sought for with greater eagerness than any other substance in or upon the earth.

Gold was used for purposes of ornament by the Egyptians at least 2500 years, and by the Greeks 1400 years, before the Christian era. These facts have been revealed by modern excavations. The use of gold as money was subsequent to its use as an ornament. It was also consequent upon such use.

The nineteenth century will be memorable as the one in which the single gold standard was adopted by civilised nations. Speaking broadly, it may be said that the ancient world had the double standard of silver and gold; that the single silver standard prevailed during the Middle Ages, from the seventh century to the thirteenth; that the double standard was then reintroduced and prevailed till the beginning of the nineteenth century, and that it has now been superseded by the single gold standard.

England adopted the single gold standard in 1816, Portugal in 1854, Germany in 1871, the United States in 1873, the Scandinavian States in 1874, Holland in 1875, France and the Latin Union in 1876, Austria-Hungary in 1892, British-India in 1893, Japan in 1898, and Russia in 1899. The gold standard prevails also in Roumania, Turkey, and Egypt. All the South American countries except Bolivia and Paraguay have adopted it, but most of them are under the *régime* of irredeemable paper. The only countries of importance which have the silver standard are China and Mexico. The latter has the double standard in law, but the single silver standard in practice. The same is true of the Central American states, except Costa Rica, which has the gold standard.

The nineteenth century will be distinguished also as the one which witnessed the greatest output of gold that the world has ever known. Two periods of extraordinary discovery and production occurred in it, one about the middle and the other near the end. According to the statistics of the Director of the Mint, the world's production of gold for the first half of the century was $787,463,000, and for the second half $6,906,679,100.

The chief gold-producing countries at the beginning of the century were Mexico, Colombia, Brazil, Peru, and Buenos Ayres in the western hemisphere, and Russia and Hungary in the eastern. Small quantities were obtained also from the East Indies and from Africa. From 1801 to 1810 the average annual yield from all countries was about $12,000,000, two thirds of which came from American mines. Revolutionary disturbances in Mexico and South America, which broke out in 1810 and continued till 1824, caused a great reduction of their output of both gold and silver. The world's production of gold declined to an average of $7,600,000 per year, which was

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not sufficient, in the opinion of Mr. William Jacob, a leading authority of that period, to supply the amount used in the arts and make good the loss by abrasion, shipwreck, and other accidents. After the restoration of peace in those countries there was a gradual gain in their production of gold. That of Russia increased also, her average output from 1837 to 1848 being $12,500,000 per year, or more than that of the whole world at the beginning of the century. The details of production for the first half of the century, as computed by the Director of the Mint, are the following:

Period	Annual average	Total for period
1801–1810	$11,815,000	$118,152,000
1811–1820	7,606,000	76,063,000
1821–1830	9,448,000	94,479,000
1831–1840	13,484,000	134,841,000
1841–1850	36,393,000	363,928,000
Half-century	$15,749,200	$787,463,000

On the 19th of January, 1848, James Wilson Marshall found a small lump of gold in the tail-race of Sutter's sawmill in El Dorado County, California. This discovery led to a search in the bed of the stream and in the adjoining ground, which was found to contain rich deposits of the precious metal. The news spread like wildfire throughout California and the Pacific coast of North and South America, and later to the Atlantic States, and all civilised countries, leading to a great immigration of gold-hunters. The production of the metal in California alone in 1850 was $36,000,000, being equal to the annual average of the whole world during the preceding decade. It reached $56,000,000 in 1851. In the latter year a similar discovery of placer gold was made in New South Wales, Australia, followed by a still more important one in the colony of Victoria. These discoveries were also attended by public excitement and heavy

immigration. The production of gold in Australia and New Zealand rose to $65,000,000 in 1854. Concurrently with these discoveries, there was a considerable increase of production in Russia, which reached $25,000,000 per annum.

The next great discovery of the precious metals was that of the Comstock lode in Nevada. This is a fissure vein four miles long in rock of the Tertiary age. It is situated at the base of Mount Davidson in the Virginia range, an offshoot of the Sierra Nevada. In the central part of the fissure its width is about three thousand feet. The gangue, or veinstone, is quartz, not uniformly distributed in the fissure, but coagulated in large bodies called "bonanzas." The metals were apparently deposited there in solution. The magnitude of this deposit may be inferred from the fact that, since 1861, when it was first worked scientifically, it has yielded $350,000,000 of bullion, and that 190 miles of shafts and galleries have been excavated in it. Forty per cent. of the bullion produced was gold and sixty per cent. silver. In 1882 the richest ore bodies of the Comstock lode had been exhausted, and the annual yield had fallen to $1,333,000, from which point, however, there was a recovery to $7,000,000 in 1887, due to the working of low-grade ores that had been previously neglected.

In the meantime (in 1884), a discovery had been made in South Africa that was destined to surpass in magnitude the Comstock and every other deposit of the precious metals that the world had ever seen. This was in the Witwatersrand of the Transvaal. Here the country rock is a bed of sandstone, interlaminated with deposits of conglomerate, which the Dutch call "banket." This conglomerate carries the gold, the average being ten pennyweights per ton of material. Borings to the depth of 3500 feet have found the gold-bearing reef undiminished. The out-croppings of the reef have been traced

for a distance of forty miles. The production of the Transvaal in 1898 was $78,070,761. There was an interruption of the working of the Rand mines in the latter part of 1899 and in 1900 by reason of the war with Great Britain. When the industry shall have been fully resumed the output will probably be not less than $100,000,000 per year. It may be much greater.

One of the most surprising discoveries of modern times is that of the gold placers of the Klondike in the Yukon territory of Canada. These are deposits underneath ground which is perpetually frozen. The method of obtaining the gold is by sinking a shaft through the frozen ground by means of hot boulders. Then a drift is run by building a fire against the face of the ground. The gravel is thrown out and left till summer, when it thaws and is washed by panning. All the gravel thrown out by two men in eight months of winter can be washed in two months of summer. Of course these deposits must have been laid down at a time when the climate of that region was much warmer than it is now. The output of the Klondike has been increasing steadily since the first discovery in 1894, in the face of enormous difficulties due to the severity of the climate and the cost of transportation. It is estimated by the Mint Bureau at $20,000,000 for the year 1900. Similar placer beds have been found at Cape Nome, Alaska, but their value has not been fully tested. They yielded about $5,000,000 in 1900.

The most important gold-bearing district in the United States now is that of Cripple Creek, Col. The ore at this place is a telluride known to mineralogists as calaverite. The country rock (says Mr. Philip Argall in *Mineral Industry*) is altered andesite, granite, or phonolite, containing thinly disseminated iron pyrites and tellurium minerals. At or near the surface the tellurium is oxydised, and the gold, when visible, exists as an

ochre-like powder, "mustard gold." By roasting, the tellurium is oxidised and the gold set free in the metallic state easily soluble by cyanide or chlorination. The estimated yield of the Cripple Creek district in 1900 was $22,000,000.

There has been a remarkable increase of the yield of Australia in recent years, which rose to nearly $80,000,000 in 1899, the increase being due chiefly to new workings in West Australia.

Statistics of the world's production of gold in the second half of the century, with details for the year 1899, as compiled by the Director of the Mint, are as follows:

Period	Annual average	Total of period
1851–1855	$132,513,000	$662,566,000
1856–1860	134,083,000	670,415,000
1861–1865	122,989,000	614,944,000
1866–1870	129,614,000	648,071,000
1871–1875	115,577,000	577,883,000
1876–1880	114,586,000	572,391,000
1881–1885	99,116,000	495,582,000
1886–1890	112,895,000	564,474,000
1891–1895	162,947,000	814,736,000
Forty-five years	$124,892,000	$5,621,062,000
Single Years		
1896		$202,251,600
1897		238,812,000
1898		287,428,600
1899		306,584,900
1900 (estimated by myself [1])		250,000,000
Second half-century		$6,906,679,100
First half-century		787,463,000
Century		$7,694,142,100

[1] Gold mining in the Transvaal was interrupted by war in October, 1899. The war continued during the greater part of 1900. But for this interruption the output of the Rand mines alone would probably have been $100,000,000 during the year, and that of the world $325,000,000.

The largest gold-producing countries in 1899 were:

Australia	$79,321,600
Africa	73,227,100
United States	71,053,400
Russia	22,167,100
Canada	21,324,300
Mexico	8,500,000
British India	8,517,500
China	5,574,400
All other	16,899,500
Total	$306,584,900

The production of the States and Territories of the United States for the same year was:

Colorado	$25,982,800
California	15,197,800
South Dakota	6,469,500
Alaska	5,459,500
Montana	4,760,100
Utah	3,450,800
Arizona	2,566,100
Nevada	2,219,000
Idaho	1,889,000
Oregon	1,429,500
All other	1,629,300
Total	$71,053,400

From these tables we learn that the production of gold in the second half of the century was nine times as great as during the first half. Such an extraordinary addition to the world's medium of exchange must have had some sensible effect upon the prices of commodities.

The amount of gold in various forms in Europe and America in 1848 was estimated by Tooke & Newmarch (*History of Prices*, vol. vi., p. 230) at $2,800,000,000, and of silver at $4,000,000,000, both metals being then available as money. These figures have been criticised by other statisticians as being too high, but we cannot hope

for accuracy in a case where the data are so obscure and uncertain. Upon this mass, whether greater or less, there was precipitated in the next twenty years $2,000,000,000 of gold and $680,000,000 of silver.

It was the opinion of Cairnes, Jevons, Levasseur, and Soetbeer that the great output of gold in the fifties and sixties had caused an average increase of the prices of commodities equal to about twenty per cent. In some cases the increase was greater than the average, in others less; and in still others it counteracted a decline of price which would ordinarily have taken place by reason of new inventions and improved processes of production. The four authorities named, working independently of each other, reached this opinion about thirty years ago, and I think that it may be safely accepted as one of the established facts of statistical science.

The way in which new supplies of gold operate on prices will now be considered. The essential quality of gold is that it constitutes purchasing power. It is *per se* a demand for goods. People do not mark up the prices of the things they offer for sale merely because new gold mines have been discovered, however rich they may be. If a portion of the community (gold miners or others) should find two dollars in their pockets where there had been only one dollar before, prices would not rise in consequence merely of that fact. Tradesmen would ask the same prices for their wares, labourers would work for the same wages as before, buyers would expect to receive the same quantities of goods for a dollar as before. But the possession of double the quantity of money by the fortunate persons would double their demand for goods, and this increase of demand would cause an advance of prices. The attempt to supply the demand would call for more labour and cause an advance of wages. Then the advance of wages would enable the wage-earners to improve their style of living by buying more goods, and

there would be a further advance in prices unless it should be counteracted by new facilities of production and transportation. Such new facilities would almost certainly be called into existence. In other words, industry would be stimulated.

It was in this way that the new supplies of gold operated to cause the advance of both prices and wages in the twenty years succeeding the great gold discoveries of California and Australia. The community was not made richer by using two dollars instead of one to transact a given amount of business, but the amount of business to be transacted was increased and the increase was of a wholesome and desirable kind, giving an advantage, as Professor Cairnes showed at the time, to wage-earners over rentiers and others having fixed incomes. The former had steadier employment and better pay, while the latter were obliged to pay higher prices for consumable goods without any enlargement of their income.

Another fact shown by the foregoing statistical tables is that the production of gold in the second half of the century reached a minimum in the period 1881–85, the average annual output being less than $100,000,000, and that soon afterwards an extraordinary increase took place. In the last decade, 1891–1900, the production was more than twice as great as that of the first decade, 1851–1860. Why has not the same effect on prices been noticed as was observed after the great output of California and Australia? There has been some advance in prices during the last two years which may, I think, be fairly attributed to the new supplies of gold. The counteracting forces of new inventions and facilities of production and transportation, and the bringing of new land under cultivation, have been very active and potent during this time. Moreover, the amount of gold in existence in 1891, upon which the new supplies impinge, is larger than the amount of both gold and silver in 1850.

Yet I cannot avoid the conviction that we are on the eve of another period of advancing prices due to the great output of gold described above, and which seems likely to continue for some years.

The use of gold in the arts, for jewelry, watch-cases, pens, gilding, dentistry, and chemistry, was computed by the Mint Bureau at $65,000,000 in Europe and America for the year 1898.

Gold is found in placers in the beds of existing rivers or in those of past geological ages, which are now dry or uplifted, or buried under new strata. It is also found in veins of rock formation. It has been found in the United States in rocks of all geological ages from the pre-Silurian to the Quaternary. It was the opinion of Professor Newberry that the metal in fissure veins was deposited there from chemical solutions forced upward from deeply buried rocks of various kinds, from which the gold had been leached under great pressure and heat. Gold is found also in bedded veins of sedimentary rock in conjunction with argentiferous galena, iron pyrites, and other metals, where there is no trace of a fissure. It has been found in common clay, and also traces of it in sea water. Placer gold has been separated from vein formations and conveyed by running water, in conjunction with gravel and other detritus, to the places where it is found.

Gold does not suffer any change by exposure to the air or by being buried in the earth. It is rapidly dissolved in quicksilver at ordinary temperatures, and forms with it an amalgam, either fluid, or pasty, or solid; according to the proportions of each metal present. The quicksilver can be distilled from the mass by heat and recovered by condensation, leaving the gold solid. It thus becomes an agent of supreme importance in the production of gold. Its use was known to the ancients. Pliny says with truth that if gold mixed with impurities is shaken in a vessel containing quicksilver, the latter

will absorb the gold and reject the impurities, and that the quicksilver can then be squeezed through a skin like perspiration, leaving the gold pure.

Placer gold is of various sizes, ranging from dust up to nuggets weighing many pounds. It is of various degrees of purity. That of Australia averages 950 in 1000, being purer than any gold coin now in use. That of California averages 884; that of Montana 895. Native gold is almost always associated with silver. In 1000 parts of placer gold of California 112 are composed of silver, and 4 of base metal. The electrum of the ancient world was native gold containing 20 to 30 per cent. of silver. The colour of electrum was pale yellow.

The most common method of obtaining alluvial or placer gold is by washing river sands. "Panning" was practised by the Egyptians in prehistoric times. This process consists in stirring with the hands a quantity of gold-bearing sand in a hollow vessel filled with water. The gold, being heavier than the other material, sinks to the bottom. The earthy matter is spilled over the top of the vessel from time to time as the stirring proceeds. When the panful has been thoroughly washed most of the gold contained in the mass will be found in the bottom of the pan. As there is always some sand and gravel left, it is customary to collect the gold by means of quicksilver.

Sluicing is the method by which auriferous sands and gravels are now attacked in places where water can be obtained in sufficient quantity. In the ancient world water from gold-bearing mountains was made to flow over hides, or sheepskins, in which the particles became entangled. Thence, probably, came the legend of the golden fleece.

Sluicing is performed by shovelling gold-bearing earth into running water, which is made to pass through a wooden conduit, on the bottom of which are fastened a

series of "riffles," or obstructions, against which the heavier portion of the material lodges. Quicksilver is fed into the stream at various places in the form of a fine rain, being squeezed through chamois leather or canvas to give it dispersion. It passes down the inclined surface and lodges with the other heavy material against the riffles, where it collects the gold by amalgamation. When the first riffle is full, the material suspended in the water passes over the obstruction and is caught in the next one, and so on till all are filled. The water is allowed to flow until all the earthy matter that the current can carry is disposed of. Then the "clean-up" begins. The gold is found amalgamated with the quicksilver.

Hydraulic mining is sluicing on a large scale, in which the force of a jet of water is used, instead of shovelling, to break down the bank and move the earth and gravel to the entrance of the sluice. For this purpose a powerful head of water is required, from one hundred to three hundred feet higher than the ground to be operated on. The water is collected in mountains, sometimes at long distances from the works, and brought in ditches which follow the contour of the country, often crossing valleys on high trestle-work or by inverted siphons. Sometimes the "pay gravel" is found where there is insufficient drainage, and it becomes necessary to excavate tunnels to carry off the tailings. One such tunnel in California is 7874 feet long. The water is delivered against the bank through an iron nozzle with something like the velocity of a cannon ball. It soon excavates a hole, which is gradually enlarged until the superincumbent mass falls down. Then this is attacked by the same means, and the whole mass begins to dissolve and follow the drainage line which brings it to the sluices constructed like those already described, but on a much larger scale. They are operated on the same principles as the smaller ones.

The disposition of the tailings has been the most serious problem of hydraulic mining in California. Not only is the natural drainage of the country altered by these operations, but stupendous quantities of earth are carried down and deposited in the beds of the rivers, which are caused to overflow their banks and spread the detritus over the adjoining lands, to the ruin of agriculture. A vast deal of litigation has ensued, and the State Legislature has been compelled to intervene for the protection of the farmers. Hydraulic mining is the most economical of all methods of obtaining gold, the cost being from 1½ cents to 8 cents per ton of material treated. The most expensive is panning, the cost of which is $5 to $8 per ton.

Gold existing in rock formation is either free-milling or combined chemically with other substances. Often both are found in the same mine. Free-milling ores are treated by crushing and then amalgamating with quicksilver. In reaching the metal and tearing it from the rock, man accomplishes with his own hands what nature has done for him in the case of placer gold.

There are numerous methods of crushing free-milling ores, the one most largely used being that of the stamp battery. The ore is first reduced to the size of a walnut by a stone-breaker. It is then put into an elongated mortar made of cast-iron which has a series of iron pestles arranged side by side, so as to be lifted, one by one, by a revolving wheel and allowed to fall. Water is supplied to keep the mass in a splashing state, and also quicksilver to amalgamate the gold as it is released from the pulverised rock. Sometimes the sides of the mortar are lined with copper plates, which have been previously amalgamated with quicksilver, as the amalgam produced in the mortar tends to adhere to the surface of such plates. The contents of the mortar are thus reduced to a "pulp," which is allowed to flow slowly over a series of

amalgamated copper plates, by which still more of the gold is amalgamated and retained, the remainder passing off as tailings. The tailings contain some gold, and are subjected to further treatment. The excess of quicksilver in the amalgam is recovered by squeezing it through filter-bags of chamois leather or buckskin, which leaves a solid amalgam. The remainder is evaporated by heat and the vapour condensed by passing through pipes which are submerged in cold water. The solidified gold remains.

There are two important chemical processes for the extraction of gold from sulphides and other refractory ores, one by chlorine, the other by cyanide of potassium. By the former the ore is first reduced to sizes small enough to expose all the gold contained in it to contact with chlorine gas. It is then roasted, either in a reverberatory or a revolving furnace, in order to expel sulphur, arsenic, and other impurities which would impede the action of the chlorine. The charge is then drawn from the furnace and allowed to cool, after which it is shovelled into a vat and impregnated with chlorine gas. Then it is leached with water as wood-ashes are leached for making lye. The resulting liquor contains chloride of gold, which is usually precipitated by adding to it a solution of sulphate of iron, the gold falling to the bottom in the form of a powder, and usually in a very pure state, sometimes as high as 990. Precipitation can be effected also by passing the solution over charcoal, to which the gold adheres, the charcoal being afterwards burned and the gold recovered.

The cyanide process is of comparatively recent date. It has been in operation in the United States less than ten years; in South Africa a little longer. A solution of cyanide of potassium will dissolve metallic gold. This affinity is now the basis of great industries and has enabled mankind to save large quantities of the precious

metal that would otherwise have been lost. The process is substantially like that of chlorination, except that roasting is not generally required. The ore is first comminuted, as in chlorination, and placed in large vats, where it is leached by a dilute solution of cyanide, the liquor being allowed to remain until all the gold has been extracted. It is then drawn off by a stop-cock into a box under the vat. The gold is precipitated by zinc shavings, and falls to the bottom of the box in the form of a slime. Another method of precipitating the gold is by electrolysis. A current of electricity is passed through the solution, and the gold is precipitated on thin sheets of lead suspended in it and to which it adheres. These are melted in order to recover the gold. More recently sheets of aluminum have been used instead of lead, as the gold can be removed without injury to the sheets. The cyanide process has added largely to the productiveness of the gold-fields of South Africa, and has made the accumulated tailings of past years a source of profit. It has made many mines profitable that could not be worked before.

It was the opinion of Professor Newberry twenty years ago that nine tenths of all the gold in the possession of mankind had been obtained from placer deposits. At the present time, the greater part of the annual increment is obtained from veins in rock formation. The methods of extracting it are endless in number and variety, but all that we need consider here depend upon quicksilver, chlorine gas, or cyanide of potassium, and of these three agents, quicksilver is still the most important.

DEVELOPMENT OF STEEL MANUFACTURE IN THE UNITED STATES

By Andrew Carnegie

TO write of the manufacture of steel in the United States during the last century is indeed to begin at the beginning, since the Legislature of Pennsylvania, as late as 1786, lent Mr. Humphreys £300 for five years to enable him to try to make bar iron into steel "as good as in England." As late as 1810, there were produced in the whole country only 917 tons of steel, Pennsylvania's share being 531 tons, or more than half of the whole. It is remarkable that the good old Keystone State still makes about the same percentage. Even in 1831 the production of steel was only 1600 tons, an amount which was said then to equal the whole quantity imported, so that the market for steel was divided equally with the foreigner seventy years ago. But this steel was made chiefly by cementation; crucible steel was to come later. From 1831 until as late as 1860, very little progress was made in developing the manufacture of steel, for the total product in 1850 was only 6000 tons, still principally blistered steel. In 1840, Isaac Jones and William Coleman began its manufacture in Pittsburgh, and succeeded. Singer, Nimick & Co. in 1853 produced successfully the usual grades of cast steel for saws, machinery, etc.; for kindred purposes Hussey, Wells & Co., in 1850, made the first crucible steel of best quality as a regular product out of American iron, and in 1862 came Park Brothers & Co., with the biggest steel plant of all up

to that time, and several hundred English workmen imported to insure success. All these concerns were in Pittsburgh.

Henceforth the struggle with foreign steel became severe, until the invader was finally driven from the field. At first, European makers could "dump their surplus" upon the market and force American makers to accept for their entire output the extreme low rates which had only to be taken by the invader for a small part of his. The party in control of a profitable home market can most successfully invade foreign markets. In recent times it is the American manufacturer who is "dumping his surplus" in foreign territory. First conquer your home market, and the foreign market will probably be added to you, is the rule with manufactures in international trade.

As I write of Coleman, Jones, Nimick, Singer, Hussey, and Park, I am carried back to boyhood, when as a messenger-boy in the telegraph office in Pittsburgh I delivered to them many a telegram, and received coveted recognition from these great men of my youth. Every one passed before my eyes as I wrote his name, as vividly as if I were still in daily intercourse with him. Were they in the next room and to speak, I could tell each voice before the word was ended. All are gone except the younger brother Singer, still my partner and friend. These are the fathers of steel in the United States. They "have done the State some service." Peace to their ashes!

It was not till 1864, when the last century was almost two thirds gone, that the revolution in steel manufacture came to us, and the Iron Age began to give way to the new king Steel, for the first Bessemer product was made in that notable year, and steel, hitherto costing from six to seven cents per pound for ordinary grades, has since sold at less than one cent per pound, while billets by the hundred thousand of tons have sold at "three pounds of

steel for two cents." Into this steel for each pound enter two pounds of iron ore mined and transported by rail and water 1000 miles, one pound of coke, requiring one and one third pounds of coal to be mined, coked, and transported 50 miles, one third of a pound of limestone, quarried and transported 140 miles; so that three and a third pounds of raw material have been made into one pound of steel and given to the consumer for two thirds of one cent, three pounds for two cents being $15 for 2240 pounds gross ton.

Were the writer asked how this miracle is performed, he could not tell, for never can he expel the doubt, when he thinks of it, that there must be some mistake, and that the concern which bestows this precious metal upon an ungrateful people for such a trifle must soon go to the wall. So, indeed, it would if this extremely low price had to be taken for any length of time, or for all forms of steel. There is not sufficient profit to cover the risks of business in three pounds of steel for two cents. Still, some of the largest concerns of the United States, which own all their raw materials and their own ships and railways and are properly equipped and managed, might reach this as their cost price, allowing nothing for dividends or for interest upon the capital invested. Interest approaches two dollars per ton and in most cases exceeds it. The risks of manufacturing, accidents and renewals, and of sales should be rated as two dollars per ton.

This low cost was made possible by the invention of Sir Henry Bessemer. Bessemer steel was enthroned as king, and no monarch seemed so sure of a long and undisputed reign, supplemented as the Bessemer process was by the invention of a young genius, my friend Sydney Thomas, who added the basic process, by which impure ores could be used in the Bessemer converter.

Various contributory causes have made $15 a ton steel

billets possible, among which automatic machinery ranks first, and in this the American excels; continuous processes second; workshops eleven hundred and twelve hundred feet long are becoming common, in which the raw material enters at one end and emerges finished at the other without handling, and often without even stopping except for reheating. The writer hears of plans to-day for new works upon such a scale that a mile and a quarter of land is required, one shop alone being three thousand feet in length. One essential for cheap production is magnitude; concerns making one thousand tons of steel per day have little chance against one making ten. We see this law in all departments of industry. It evolves the twenty-thousand-ton steamship and the fifty-ton railroad car. Improved engines and the use of electricity as a motor, the new loading and unloading machinery, are all contributory causes to the cheapening of steel. There is one element of cost, however, which every student of sociology will rejoice to know has not been cheapened, and that is human labour. It has risen, and the tendency is to higher earnings per man. In one of the largest steel works last year the average wages per man, including all paid by the day, labourers, boys, and mechanics, exceeded $4 per day—for 311 days. Fewer men being required, the labour cost per ton is less, and contrary to the opinion often expressed, these men are of higher quality than ever as men. It is a mistake to suppose that men are becoming mere machines; the workman of former days would be unable to take charge of the complicated machinery of to-day, or to meet the demands made by present methods upon his brain and alertness.

Five years ago had one asked the steel-makers of the country whether there was any likelihood of the Bessemer process being rivalled, not one in a thousand would have hesitated to reply with an emphatic, Never! But the

one in a thousand, conversant with recent experiments, would have been less emphatic, and intimated that perhaps even the Bessemer process might not remain without a rival.

The merits of the open-hearth Siemens furnace had been noted by at least one firm whose representative visited concerns abroad. The Thomas basic process was found to be remarkably well adapted to the open-hearth furnace, and an enterprising party in England had made some scientific experiments with it. To Cooper, Hewitt & Co. is due the credit of having been the first to experiment with it in the United States. The cost of open-hearth steel was necessarily greater than the Bessemer, and so was restricted to few uses, but a new plant was only needed on a large scale, ready to benefit by the numerous improvements which clever men made in the course of development, to place the new process securely upon its feet as a rival to the Bessemer. There are now two kinds of steel made in the open hearth, the acid and the basic, the latter much cheaper than the former, though even purer, since the basic process eliminates the impurities thoroughly. Basic open-hearth steel is now used as a substitute for Swedish iron in many instances, even for horseshoes. Armour is made of it. The East River Bridge is to be built of acid steel, for which a higher price is paid, but this is solely because its engineer is not open to demonstration. Its great advantage to the United States is that our enormous quantities of ores containing high phosphorus can be used for steel, while the Bessemer process requires ores comparatively free from this, the supply of which is limited. The product of open-hearth steel is rapidly increasing.

Thus, the age of iron, which passed away during the last century, was succeeded by the age of Bessemer steel, which enjoyed a reign of only thirty-six years, beginning, as it did, in 1864, and is in turn now passing away to

be succeeded by the age of Siemens open-hearth steel. Already the product of open hearth is far beyond that of Bessemer in Britain, and such the writer ventures to predict will soon be the case in the United States.

The passing away of the Bessemer age has brought the South into prominence as a possible manufacturer of steel, when otherwise it never would have been in the field, its ores being unsuitable for the Bessemer, but probably soon to be proved adaptable to the open-hearth process. Until the new steel works of the Tennessee company have been fully started and run for some time it cannot be completely demonstrated whether steel can be made there cheap enough to make the South a great centre for its manufacture. The experimental stage has not yet been clearly passed, since only part of the plant has been operated, but there seems little reason to doubt that any difficulties which may be met with will finally be overcome, and that the South is to become an important factor in steel manufacture.

The present centre of steel is in the square made by a line drawn from Pittsburgh to Wheeling, northward to Lorain, eastward to Cleveland, and south again to Pittsburgh. In this territory most of the steel is made. Allegheny County alone (Pittsburgh) in 1899 produced nearly one quarter of all the pig-iron in the United States, almost half of the open-hearth steel, and almost thirty-nine per cent. of the total production of all kinds of steel. As far as the writer sees, there is little chance of this region being soon displaced; Colorado will, no doubt, expand as the Western coast is developed; Chicago's position as a steel manufacturer is assured. There is no sign of the great South-west making steel to any extent. As late as the middle of the last century the Eastern States upon the Atlantic constituted the home of steel manufacture. Even in Pennsylvania the half of all the steel was made east of the Alleghany Mountains. Since then the trend

has been constant and rapid to the region known as the Central West, which has Pittsburgh as its metropolis. The transfer of the great Lackawanna Iron and Steel Works of Scranton, Pa., to Buffalo, and the splendid triumphs of the Bethlehem Company (Pennsylvania), in armour, guns, and forgings, as specialties which give it a unique and commanding position, are proofs that for the making of ordinary steel the location is not favourable. The history of the steel works at Troy is another case in point. There is one exception to this march westward, at Harrisburg, in eastern Pennsylvania, which remains a prosperous and important centre of manufacture. The Maryland Steel Company at tide-water has advantages for export, but probably more important for the future of that company are its developments in ship-building, for which it is peculiarly well adapted. So far as the writer sees there is nothing to change the national centre of steel manufacture in the new century; it is in the Central West already described, and there it is likely to remain.

In that centre itself there are causes at work which may lead to some important changes. The wonderful growth of the lake cities on the northern border of the Central West region is shown by the recent census. These possess the advantages of the extremely low cost of lake transportation, the Welland Canal, by which vessels of considerable tonnage can load at Conneaut and other lake ports direct for Europe, and above all, the low rates which the Erie Canal insures manufactures for more than half the year. These are attracting attention especially since an effort is being made to weld the trunk railway lines into one directorate to enable them to exact higher rates of freight when lower prices for service or articles seem to be the prevailing law. The selection of Buffalo by the Lackawanna Steel Company for its new works is evidence of a movement to the lakes. The policy of the railroad combination will inevitably operate in

favour of the southern ports and to the disadvantage of New York. The differential of three cents per hundred in favour of Baltimore and two cents in favour of Philadelphia over New York certainly means that the traffic will continue to seek these ports, and that New York's percentage of the shipping trade will steadily fall, as it has been doing. It is not to be supposed that the city and State of New York will fail to protect their position by improving the weapon which New York State alone of all States has in her waterway from the lakes to the port of New York. The writer takes this for granted, and consequently predicts a great development in steel manufacture in that part of the Central West lying along the southern border of Lake Erie, which will inure to the benefit of New York as being the port which may be reached cheapest from the Central West by water. One of the features of the coming century is to be a return to water transport for heavy materials. Lake ships of seven thousand tons burden already exist. Barges will ply upon the Ohio River, soon to be slack-watered, and upon the enlarged Erie Canal, as also upon that from Chicago to the Mississippi; and many other waterways will be opened upon which the raw materials for steel and the finished article itself are to be carried by manufacturers at rates already reached upon the lakes, one third and often one fourth those charged by rail.

It is scarcely within the bounds of belief that any cheaper or better process of making steel remains to be discovered, or that improvement upon present methods can possibly be such as greatly to reduce cost and enable steel to be made without loss at less than three pounds for two cents. The twentieth century, with all its wonders yet to be revealed, will probably end with the manufacture of steel substantially as it is now, by the open hearth. There does not seem room for much improvement.

The last few years have witnessed the export of steel from our country to other lands. The republic has not only supplied her own wants, but is competing to supply the wants of the world, not only in steel, but in the thousand and one articles of which steel is the chief component part. The cheapness with which steel is made is multiplying its uses to such an extent that estimates made of the possible wants of the world in the future can only be guesses. One illustration out of many that could be given is that three years ago there was not a ton of steel used for railway freight cars; to-day a thousand tons of steel per day are used for that purpose alone — indeed, so rapidly is the use of steel extending that it is difficult to see how the world's demands can be filled. At present the mines of ironstone and of coking coal in Britain are worked to their fullest capacity, and yet the output is not greatly increased; it is the same with those of Germany, except that in the latter country there remain some inferior fields capable of development if prices rise, as is probable. Russia so far has not been much of a factor in steel-making; if she is able to supply her own wants by the middle of the century she will be doing well. Except by the United States, Britain, and Germany, little steel is made, nor is any other nation likely to make much. The hopes in regard to China and Japan making steel, the writer believes, are to prove delusive. Britain and Germany cannot manufacture much beyond what they do now, so that the increased wants of the world can be met only by the United States. The known supply of suitable ironstone here is sufficient to meet all possible demands of the world for at least half of the century; in the case of coke, for the entire century. It is not to be supposed that other deposits will not be discovered before known supplies are exhausted.

A few years hence the export of steel and manufactures of steel from the republic to many parts of the world,

which in 1899 were valued at $119,000,000, promises to be so great as to constitute another chapter in the record-breaking history of steel.

The influence of our steel-making capacity upon development at home must be marvellous, for the nation which makes the cheapest steel has the other nations at its feet, as far as manufacturing in most of its branches is concerned. The cheapest steel means the cheapest ships, the cheapest machinery, the cheapest thousand and one articles of which steel is the base. We are on the eve of a development of the manufacturing powers of the republic such as the world has never seen, and the writer who is honoured by being asked to write for a similar series its record of the twentieth century may present figures as surprising as I have to submit for the nineteenth.

The republic's progress and commanding position as a steel producer are told in a few words:

In 1873, only twenty-seven years ago, the United States produced 198,796 tons of steel; Great Britain, her chief competitor, 653,500 tons, more than three times as much. Twenty-six years later, 1899, the republic made more than double as much as the monarchy, the figures being 10,639,957 and 5,000,000 tons respectively, an eightfold increase for Britain and fifty-three-fold for the republic; and almost 40 per cent. of all the steel made in the world, which was 27,000,000 tons. Industrial history has nothing to show comparable to this.

So much for the past; as for the future, ere the present century runs one third its course, perchance one fourth, the United States is to make more steel than all the rest of the world combined, and supply the wants of many lands besides her own.

Farewell, then, Age of Iron; all hail King Steel, and success to the republic, the future seat and centre of his empire, where he is to sit enthroned and work his wonders upon the earth!

LIBRARY DEVELOPMENT

By Charles A. Cutter

IN the first year of the nineteenth century the United States, with a population of five and a third millions, had sixty-four libraries intended for popular use, or, if we call the parochial libraries founded by Dr. Bray public, and assume that most of them survived the Revolution, there were one hundred libraries, containing perhaps fifty thousand volumes in all. In the last year of the century there were over ten thousand libraries, owning forty million volumes, half of these libraries having over one thousand volumes each. Thus while our territory is less than four times as large and our population is only fourteen or fifteen times as large, there are one hundred times as many libraries, containing eight hundred times as many books.

There is no means whatever of ascertaining how many volumes reached the readers of 1801, but it is unlikely that the output exceeded the stock, for it was a time of solid books and slow readers. In 1900, fifty million volumes were issued; that is, the circulation has grown a thousand-fold.

Americans have always been a bookish people. The very first colonists brought books with them from Europe. There were books, few but prized, in many households, and in time some private libraries of size and fame. Public libraries have a history almost as old. The Puritans had hardly landed when they founded a college, and with it a library. Harvard College Library, born in

1638, was followed in 1700 by two others, Yale and William-and-Mary; and by twelve others in the following hundred years, so that our century began with fifteen college libraries; it ended with over forty times as many.

Joint-stock libraries, implying cities and a certain amount of wealth, were of later origin. The first was founded in 1731 (twenty-seven years before the first proprietary library was established at Liverpool, England). By the end of the eighteenth century there were thirty-two such libraries. There are many more now, for they spread gradually throughout the country, often under the name of Athenæum in the cities and of Social Library in the country. But they are not flourishing as a class, for the free public libraries are slowly ousting them. People in general will not pay for reading when they can have it for nothing. A few, either from old habit, or because they dislike the rush and bustle of a public library, or because membership is regarded as a social distinction, will frequent the proprietary library and pay their yearly dues, but the receipts from this source are too small for its whole support. With a large invested fund, it may survive; without one it is doomed either to be dissolved or to be absorbed by the free library. In those States, to be sure, where the latter has not gained a foothold, the proprietary library continues its good work, and new ones may spring up. They are then very useful in showing the people what libraries are and in preparing the way for the adoption of permissive or compulsory library laws. Many were founded in the decade before and the decade after the Civil War; yet in 1896 only fifty-seven were reported that had over one thousand volumes apiece.

The libraries of 1801 were small in a degree hard to realise, with our present ideas of necessary size. The oldest of them, Harvard College, had in 1790 only 12,000 volumes; the largest, the Philadelphia Library Company,

after absorbing three similar libraries, had in 1807 only 18,391; in 1793, the New York Society Library had 5000; in 1791, Yale College had only 2700; in 1811, the Charleston Society Library had reached 7000; and, in 1809, the Boston Athenæum, founded only two years earlier, could report 5750. These were the giants; no other library had 2500; not half a dozen had 1000; the average was 500.

The character of the libraries was much more solid, or if one pleases, heavy, than now — necessarily so, for the books of that day were in greater proportion serious. The college libraries were of course designed to be learned, for the use of the professors chiefly. In them theology naturally held the leading place, as the colleges had been founded mainly to educate ministers. So in the Harvard College Library catalogue of 1790, one hundred and fifty pages out of three hundred and fifty are filled with theology, ten with the Greek and Latin classics, four with books of travel, but only three fourths of a page with periodicals; in literature, however, one finds Chaucer, Shakespeare, Spenser, Milton, Dryden, Pope, Gay, the *Gentleman's Magazine*, Rabelais, La Fontaine, Voltaire, Boccaccio. In 1765, Yale College was "well furnished with ancient authors, such as the Fathers, Historians, Classics, many and valuable works of divinity, history, philosophy, and mathematics, but not many authors who have wrote within these thirty years."

The social libraries were different. The Library Company of Philadelphia, whose selection probably was largely determined by Franklin's taste, no doubt was imitated by other proprietary libraries. It had scarcely one theological book or controversial tract; politics was not prominent; history, travels, science, natural history, and especially the mechanic arts, formed the bulk of the stock (but it must be remembered that a dozen of our sciences and a score of our arts had no existence then). Polite literature was scantily represented, especially in the

department of fiction, the Library Committee in 1783 having instructed its London agent that though not averse to mingling the *dulce* with the *utile*, they did not care to have him buy any novels—a rule which has largely prevailed since.

Art, which in the last decade has begun to fill so large a place on our shelves, was not to be found in any of the early libraries. The Boston Athenæum, however, received in 1838 from a generous proprietor a large number of works of art, and became the pioneer of bibliothecal art development.

The character of the reading differed somewhat from ours. It was in larger proportion the reading of the man who is curious about some one branch of knowledge, or the reading of the man who in a general way wants to improve himself. Fiction, which supplies seventy-five per cent. of the circulation of the modern town or city library, was not furnished by either the college or the association libraries. For that the readers went to the circulating libraries, which no doubt seemed to the Sir Anthony Absolutes in this country, as they did in England twenty-five years before, "an evergreen tree of diabolical knowledge." But the proprietary libraries had been founded by "gentlemen desirous of promoting the diffusion of useful knowledge and extending the means of information," and, as Duché writes in 1774, "for one person of distinction and fortune there were twenty tradesmen that frequented the library." These men came there to learn. It may be doubted whether women frequented the libraries at all. Amusement, the culture of the imagination, the culture of a love and appreciation of beauty must have been very much in the background.

The next variety of library to be established was the mercantile, with which are to be joined the young men's associations, mechanics' institutions, and apprentices' libraries. They sprang up in connection with the marked

educational movement of the second and third quarter of the century, were designed mainly for young men who could not afford to purchase a share in the joint-stock libraries but could pay a small annual fee, and they usually had classes for evening instruction and courses of lectures. They were another step in cheapening knowledge. Like the social libraries, they flourished for a time, and are still useful where they have become solidly established, or in States where the free-library system has not yet penetrated, but they are destined to give way in time to their powerful rival.

They had an effect probably not in the least contemplated by their founders. Like all libraries, they were continually in want of money; they obtained it by extending their membership beyond the merchants and clerks of the original plan to anyone who would pay the annual fee. To attract the public it was necessary to provide what the public wanted to read; going into competition with the circulating library, they adopted its tactics, and the mercantile became as much lighter than the social as the social was lighter than the college library. So was the way prepared for the free public library both by a lessened cost to readers and by a mitigated austerity in book selection.

The inadequacy of these libraries for any thorough investigation compelled the formation of special libraries—historical, theological, law, medical, scientific, Oriental, and society. The century came in with five or six of these, and closed with as many hundred.

The private libraries were intended for the owner and his friends; the college libraries for the professors and their students; the proprietary libraries for the stockholders and their families; the mercantile, at least primarily, for the merchants and their clerks; the other libraries for limited classes. So far there were none for all the people, and none free. But in the Northern

States all the people were beginning to want reading, and were rapidly becoming willing to tax themselves for it. With the second third of the century began a new era, which the little town of Peterborough in New Hampshire had the honour of inaugurating. At the instance of the Unitarian minister, a free library was founded in 1833 by an appropriation that has been continued annually to this day. Thus America became the birthplace of the free library, for the leaders of the movement which resulted in the Library Law of 1850 in England have said that they derived the idea from this country. But the town was in advance of its time. Thirteen years passed before another little town, Orange, in Massachusetts, ventured on the same step; four years later Wayland followed. Neither of these had any right to spend their money so, but their lawlessness was not rebuked, and perhaps contributed to the passage of the acts by which New Hampshire in 1849, and Massachusetts in 1851, authorised any town to tax itself for a free public library.

A Bostonian has expressed his surprise that " Boston, a city with traditions of intelligence and education, gave no indications of considering this matter of free libraries till " it was over two hundred years old. He might have added that she spent a long time in considering; there were eleven years between the first suggestion and the decisive action in 1852. But when she finally adopted the idea there was no hesitation in carrying it out thoroughly. She has ended by collecting the largest stock, erecting the costliest building, and for the first forty years having the largest circulation of any city in America.

Nor is this all. The library was in the hands of men who felt that this new creation had in it the potency of all libraries, that it might do the work of all that had preceded it and its own peculiar work besides. In other

places some parts of a library's function may have been better developed, but nowhere yet has the happy combination of private and public liberality made it possible at once so thoroughly to suffice for learned research even of the specialist, gratify cultivated curiosity, please the bibliomaniac and the dilettante, foster idle meditation, or stimulate vigorous thinking, while yet not neglecting to meet every want of the general reader, even the want of amusement and illusion, and, more than this, to attract to itself and to train adults who have never been in the habit of reading at all, and children who have not yet learned to read with profit. If in any way the library falls short, it has been in this latter work, which Western librarians have taken up enthusiastically and pursued most successfully.

Another class of free institutions had its origin a little after the town libraries. In 1835, a law of New York permitted each school district to tax itself $20 to found, and $10 a year to maintain, a free public library. But as the people would not tax themselves, the friends of the measure persuaded the Legislature in 1838 to appropriate $55,000 a year to purchase the books. Fifteen years later the libraries had over 1,600,000 volumes, but they were very little used, except in the cities, and the system was an entire failure. Eleven years later, after half a million more had been spent, there were half a million volumes less. A school district is perhaps too small a territory for a successful library, but the real cause of failure was that among a people who are not eager for it reading will not take root except by wise management, and the charge of these libraries was in the hands of men who were not interested in them. A library always suffers when ruled by a school board—persons who, if not chosen for political reasons, are selected for their ability to administer an institution which has this only in common with libraries, that it is educational, but otherwise differs entirely in

aims, personnel, material, and methods. In this case, there was not even the safeguard of a librarian to look after the library's interests. The school trustees were often incompetent to select the books, and accepted any rubbish that booksellers might offer. Such libraries, of course, did not attract readers. In 1892, New York wisely separated school libraries confined to school use under direction of school authorities from town libraries for public use under direction of trustees.

The century's library history falls into two main periods, the first three quarters and the last quarter. The first is characterised by paucity, poverty, slow increase, slow development of purposes and methods, by conservatism, limitation, and restriction. The latter period shows an astounding increase in number and size, money given in an increasing ratio, library buildings going up all over the land, their suitability to their purpose improving, experiments making in administration, new channels of library influence constantly opening, the collection of books, though no longer considered the main object, going on more rapidly, the use of the books, now regarded as the supreme consideration, daily spreading in all directions. The causes of this luxuriant growth are many. Chief, no doubt, is the increase in population and wealth, which has at the same time led to the foundation of hosts of new libraries and quickened the growth of those planted during the first period. Another cause is the spread of education and culture, furnishing an army of readers, with awakened minds. But it is to the librarians that are due the enlarged ideas of the library's mission and the discovery of the quicker and more effective ways of working which, by doubling the reach and power of libraries, have strengthened their hold upon popular favour and reinforced their appeal for philanthropic support. The change began when a hundred librarians met at Philadelphia during the Centennial

Exhibition to exchange views and make one another's acquaintance. The librarian of 1876 was busy in his own library, and seldom heard what others were doing. There was little spread of professional ideas and no co-operation. The American Library Association, which was the result of the Philadelphia meeting, and the *Library Journal*, founded at the same time, have changed all that and brought improvement into every branch of library economy. A previous convention, in 1853, though it promised well, came to nothing. The greater success of the meeting of 1876 was due in part no doubt to the ripeness of the time, to the elimination of the slavery question, to the greater culture of the nation, but mainly to the efforts of a small group of men who did not allow their interest to die out.

The essays by the leading librarians of 1876, published in a thick volume by the National Bureau of Education, the papers and discussions at the conferences, and the other matter that fills the thirteen thousand pages of the *Library Journal* treat mainly of the five classes of subjects in which there has been the most progress—library establishment, the profession, the building, the management, and the methods of reaching the public.

The trend of opinion is towards libraries established by legislation, supported by taxation, helped as far as possible by private generosity, managed by their own authorities, free to all, the library of the people, by the people, for the people. Such libraries are coming into existence fast. To assist their establishment, seventeen State library commissions have been organised, the first in Massachusetts in 1890. They work differently, according to the different needs of the States, but they all aim to fan library zeal where there are libraries, to arouse the desire for them where there are none, to distribute public aid to poor towns, and to encourage private giving everywhere. But legislatures should take one more step and

oblige towns to have and properly maintain libraries as they already require them to provide schools.

The gifts to libraries, though far smaller than those to colleges, owing in part perhaps to the more effectual solicitation of college presidents, have been remarkably generous—at least twenty-five millions in the last ten years. The larger part of the greater gifts have come from men who had made their own fortunes and desired that others should have the opportunities of learning which they had missed in their poverty-cramped boyhood. Many library buildings and some endowments have been given to country towns by farmers' sons who, having migrated to cities and found success there, sent this token of regard to their old homes. Less, probably, has come from inherited wealth; how much less statisticians have not stated. Most donors, it is found, prefer to give something material and visible—a building rather than a fund for buying books, books rather than a fund for making them most useful. But there are a few laudable exceptions.

The old writers on library topics were always prone to enlarge upon the qualities needed by the librarian. They would have him in business a hustler, in learning a scholar, in bookbuying a critic,—but a broad-minded critic, — in memory a Magliabecchi, in languages a Mezzofanti, in tact a Metternich, in administration an organiser and a disciplinarian, in temper an angel, and everywhere an enthusiast—for the librarian who is indifferent is lost. But such prodigies must always have been rare, and even they could not alone have met the demands of a modern library. He needs assistants. It was early seen by the association that the best work could be done only by specially educated persons; that librarians were constantly losing time in training new assistants; that libraries were continually checked in their progress while librarians without experience were

learning their trade, and that many were condemned to stagnation because the new librarian simply plodded on with more or less stumbling in the footsteps of his predecessors. The solution first suggested was apprenticeship; the next, more radical and more efficient, was a library school, corresponding in thoroughness to the schools that fit men to be doctors, lawyers, and ministers. There are now four such schools, whose graduates are eagerly absorbed by libraries, to say nothing of the summer schools, which give those who cannot afford a full course such a smattering of library knowledge as can be acquired in six weeks. Besides this, a number of large libraries take apprentices, from whom their staff is recruited or the neighbouring small libraries are supplied.

As a natural result a change has come about in the appointment of librarians. Formerly it was too often the man who had failed in the pulpit, the court, the schoolroom, or even the shop, who got the votes of compassionate committees. It is an advance that these votes are often given now to men who have succeeded in some such occupation, with the idea that they will therefore succeed in a library. Nor are these appointments always unfortunate; after all, ability is the main thing; yet they leave something to desire, for though it is true that a man may guide himself by the practice of his predecessors, yet the greatest success does not rise from following precedent, but from knowing when rules can be disregarded and when they cannot—a knowledge that comes only from a thorough acquaintance with the subject-matter. The next step will be for all appointing bodies to require, as many do now, both ability and experience.

Architecture has lagged behind other branches of library practice, partly because the needs of a library have been expanding so fast, partly because libraries have been designed not so much for use by men who had tried them and had learned their defects, as for show by

committees and builders. Bad ventilation is common, bad lighting universal; one hears of libraries without class-rooms for the public or working-rooms for the staff; they are continually made with no provision for enlargement, though nothing grows more surely than a library's stock of books and number of readers. Some have been built too small even for the books that the library had already. Even for show they have not till very lately reached much success. We have not even found a characteristic style of architecture. Everyone knows a church, a theatre, a railroad station, when he sees it. One seldom knows a library if it is not labelled. The ordinary library building might be taken for a school, a bank, a court-house, or a municipal building. Yet the way to a style was plain. A library has one need which should give rise to distinctive features. Its reading-rooms, its study, and its workrooms must be very light, much lighter than the rooms of a dwelling-house. This necessity ought to show in the design. The stack must not only be light, but must be lighted in a peculiar way which alone would mark the building as a library—by a series of lofty, narrow windows, separated by still narrower columns or sections of wall, a difficult matter to treat without bareness and monotony, yet surely not beyond the capacity of the American architect.

The library building of 1801 was in most cases one room, shelved around the walls. When too many books accumulated for the wall space, they were put into cases projecting from the sides. The evolution of a century has differentiated this single cell into a score of different parts, each with its own function: for work, the packing, accessioning, cataloguing and classifying, binding, printing, mechanics' rooms; for the personnel, the trustees', librarian's, staff's, janitor's rooms; for the public, the cloak and hat, toilet, charging, reading, current-periodical-reading, and standard-reading rooms, and sometimes

the dining-room; for special kinds of stock, the rooms for bound periodicals, manuscripts, maps, patents, public documents; for special classes of users, the study, class, lecture, art rooms, the photographing-room (with a developing closet), the music-room (with a piano and deadened walls), the room for the blind, and the children's room. All of these are needed in the largest libraries; many of them are already to be found in them; the children's room is needed everywhere. In the smaller libraries, of course, one room plays many parts.

In the first years of the library awakening the most attention was paid, as was natural, to details of management—the length of shelves, the form of the accession book and the binder's schedules, the size of cards and their ruling, to questions of movable or fixed shelves, movable or fixed location, stamping or embossing title-pages; in fact, the things which are now taught in the library schools, the a, b, c of the profession. This excited some ridicule, as also was natural. It was called pedantic; people said that too much time was spent in distinguishing tweedledum from tweedledee; that the loss of originality was too high a price to pay for a doubtfully desirable uniformity; that in absorption in mechanical details the things of the spirit would be forgotten. They were right and they were wrong. It was necessary that these questions should be settled before attacking the deeper problems. One must forge one's weapons before one goes into the fight. It is best to be thoroughly familiar with one's tools before one undertakes complicated work. Both dangers that were feared are real, but against them stand American inventiveness, which will not be made to halt at any one stage of achievement, and the missionary spirit, which can never be content with mechanics, but must be saving souls—in the library way. The leaders had no fears, and they were justified. In the last half of the last quarter of the century, great

as has been library progress in everything else, the progress in ways of reaching the public has been greater. Go into a modern library, and see the steady stream of books flowing into the hands of every class in the city, their time of waiting reduced to a minimum; see hung up near the delivery desk lists of the best new books, made attractive by pictures and instructive by criticism; at the information desk watch the versatile clerk answering a constant succession of questions about the most diverse subjects, telling one where to look, rescuing another from a fruitless search, explaining the reference books, directing to the shelves, guiding the reading; see in convenient nooks the portraits of authors whose birthday is at hand, hung over tables covered by their writings and the works about them, or look at other tables spread with the best that the library has on approaching anniversaries, Christmas, Halloween, the discovery of America, at once showing the resources of the library, and suggesting to frequenters to read for some better object than entertainment or novelty; go into the children's room, mark their satisfaction as they cluster round the shelves and discuss their favourite books, or sit absorbed, the older ones in magazines, the younger in picture-books; see their friend the attendant helping them, or rather showing them how to help themselves, now and then putting in a word about their choice of books, but obtruding nothing; in a class-room see a school-teacher showing her scholars the books that illustrate their lessons; go into the exhibition-room and see the lines of photographs illustrating some great painter, or the architecture and art galleries of some famous city, the dwellings and peasantry of some unknown country, the peaks and glaciers of a great range of mountains; hear in one room a man reading to the blind, in another a musician trying music, in a third see a photographer reproducing manuscript documents; here a clerk is despatching books borrowed by a distant library

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

for one of its clients, there another is choosing books which are sent once or twice a week to a delivery in an outlying village; an intelligent assistant will go with them and, knowing all the borrowers, will recommend to each the book which will suit him best, gently leading him to better reading—a sort of pastoral care that it is not easy to give in the rush of the crowded central delivery-room; note that this goes on ten or twelve hours every day in the year; that it is free to all; that if formerly libraries were for the learned, now it is certainly to the ignorant that the gospel of learning is given; and then say whether the public library is failing in its duty to the community.

From time to time someone is alarmed at the extension of library activity, and cries "*panem et circenses.*" But the *circenses*, which being interpreted is novels, are so inextricably bound up with the educational work of the library, being the inducement to many to come and be taught, and they are as now written so largely educational themselves, that their supply will stand or fall with the libraries. For the *panem*, the solid work of the library, whose paying for out of the public pocket seems to certain theorists of dangerous tendency, only to be justified on socialistic grounds, the extremest individualist admits the necessity of combining for the public defence, and it is abundantly clear that general ignorance menaces an attack not merely on the republic but on civilisation. Moreover, it is the Anglo-Saxon way—and we are still largely Anglo-Saxon—to make theories after trying experiments. We are at present thoroughly committed to the experiment of universal education. We are hoping to find that it not only imparts information and sharpens intellects, but counteracts temptations and lessens crime, increases the earning power of the individual and the effective force of the nation. Few things can be made certain in sociology, but if after a time the prophylactic power of education appears probable the

existence of libraries is justified, for there is no doubt that they are educative. They take up the work where the schools are compelled to lay it down for the majority of the community, and they carry it on through life; they are doing this with greater and greater effect as the schools succeed more and more fully in giving to their pupils their best gift,—the power of self-education.

THE PHENOMENON OF AMERICAN LIFE ASSURANCE

By James W. Alexander

THE ordinary mind fails to grasp the significance of the enormous figures representing the business of American life assurance companies at the present day. The accumulated funds of the companies reporting to the State of New York in 1899 were over $1,500,000,000, and the assurance in force in these same companies was over $6,200,000,000. When it is considered that these enormous sums have been almost entirely rolled up during the last fifty years, one is inclined to ask whether it is magic, or a natural evolution, or the result of remarkable enterprise and industry. The existing American companies have during the past fifty years paid out, in the shape of matured policies, dividends of profits, surrender values, etc., more than $2,300,000,000. If what is known as "industrial" business were added to the above figures, the assurance in force would be larger by over $1,200,000,000, and assessment and fraternal assurance would add nearly $5,000,000,000 more.

It may assist the imagination in realising the immensity of these sums to compare the accumulations of the standard American life assurance companies with some other large masses of investments. For example, the national debt of the United States is $1,015,688,190, or about two thirds the amount of the accumulated funds of the American life assurance companies reporting to the State of New York. The capital of the Bank of England is

£14,553,000, which at $4.80 would be $69,854,400, or about one quarter of the accumulated assets of any one of the three largest life assurance companies of America, and less than one twentieth of the accumulated funds of all the American companies reporting to the State of New York. The combined capital of all the national and State banks in New York City is less than $75,000,000.

In support of the statement that the great sums of money and obligations accumulated by the American life assurance companies have been chiefly rolled up within fifty years, it may be stated that the entire assets of the eleven life assurance companies existing in the United States in 1850 amounted to little over $4,000,000, and the amount assured by policies then existing hardly exceeded $58,000,000.

The returns of these companies, as collated in the first annual report of the Insurance Commissioner of Massachusetts, made in 1855, indicate that the business of life assurance at that time was in an exceedingly crude state, both as to volume and method, and it would astonish many an agent engaged in soliciting business for companies in modern times, on the basis of large dividends of profits, to see how little in that day was made of this feature of the assurance contract, the attention of the officers being concentrated upon the elements of permanency and certainty of payment. One company says in its official report: " We disapprove of dividends, except conditional dividends, and hope to see the system abandoned." Another company answers: " Dividends annually, if the condition of the company is such as to admit of the same safely, and then declared in scrip." Another says: " Dividends paid at the discretion of directors." These admissions by the American companies in their infant stage are almost comical when compared with the modern returns, showing, for example, that during the year 1899, $20,917,143.29 in dividends

were *paid* to policy-holders by the companies reporting to the State of New York, and, besides, $224,402,606.50 of surplus were held for apportionment and distribution at times when future dividends fall due under the contracts.

If the tremendous results of the American companies were due to a natural and spontaneous evolution, we should expect to find a similar condition of things in other countries than the United States, but this is not the case. Life assurance was, indeed, a gradual development in the older countries. It would be difficult to state accurately how early the principle of mutual assurance was put into some kind of practice. Ordinances are discovered in France and other Continental countries as early as the sixteenth century prohibiting any assurance on the life of men, showing that the practice must have obtained before that time, and was then frowned upon. Modern assurance in any organised form seems to have been first adopted probably as early as the fifteenth century. The first English statute on this subject was passed in 1601, and recites that "it hathe bene *tyme out of mynde* an usage amongste merchantes, bothe of this realme and of forraine nacyons, when they make any greate adventure, to give some consideracion of money to other persons to have from them assurance made of their goodes." Organised fire insurance seems to have dated from the latter part of the seventeenth century. Annuities and tontines were also known after the middle of the seventeenth century, and it was in the latter part of this century that Halley, the Astronomer Royal of that day, published what is known as *The Breslau Table of Mortality*. This was one of the earliest steps taken towards the recognition of life assurance as a science, and the study and development of the science in a practical way are indicated by the successive mortality tables, each improving on its predecessor.

The first organised life assurance institution in England was the Amicable Society, founded in 1706, but the real history of British life assurance begins with the organisation of the Equitable Life Assurance Society in 1762, and Dr. Price, who repeatedly did work for that company, constructed the *Northampton Mortality Tables* in 1780, which was long regarded as a true guide to the expectation and duration of life, and is still used by the Supreme Court of the State of New York as a basis for estimating the value of certain life estates. The *Carlisle Table of Mortality* was published by Mr. Joshua Milne in 1816, from observations upon the mortality of two parishes in the city of Carlisle. This table is still in use, even among some American companies, for annuities, but has been generally supplanted by later and more appropriate tables deduced from the experience of many life assurance companies, the principal tables being the *Actuaries*, or *Seventeen Offices Experience*, *The Institute of Actuaries Experience* (1863), *The American Experience* and the new experience just published by the Institute of Actuaries, which now form the guides for American assurance organisations.

The history of life assurance in Great Britain, from the latter part of the seventeenth century to the present time, has been one of gradual growth. In 1867, a list was published of over three hundred and fifty life assurance companies that had been organised in Great Britain. Many of these were "bubble" concerns, as may be inferred from the fact that to-day there are less than one hundred British companies doing business in ordinary life assurance. The total ordinary business in force in these companies is a little over £600,000,000 or, at $4.80, about $2,880,000,000, and the accumulated funds of these companies is only a little over £269,000,000, or, at $4.80, about $1,291,000,000. Thus it appears that in what may be called the birthplace of life assurance, the ac-

cumulated funds of one hundred and twenty-five years are about $209,000,000 less than the American companies have accumulated in fifty years, and the outstanding assurance of the former is less than one half of that of the latter.

If we pursue our investigations into Germany, we find that there are sixty-four companies, whose amount of assurance in force is over $1,688,000,000, and whose total accumulated funds are more than $523,000,000. In France there are seventeen companies, whose amount of assurance in force is $663,700,000, and their accumulated funds are over $392,000,000.

How, then, is the enormous advantage in progress of the American companies to be accounted for? The answer is, by American enterprise and industry. There are men living who have observed the progress of life assurance in America during the last half-century who can testify to the truth of this assertion. I think it will be generally admitted that the late Henry B. Hyde, the founder of the Equitable Life Assurance Society of the United States, and afterwards its President, more than any other one man injected a spirit of aggressive energy into the business. From the time that he entered the field, what had theretofore been an easy-going and sluggish conduct of life assurance affairs became an active, vigorous, competitive administration. The ingenuity of mathematicians and business men began to be taxed to devise methods in connection with assurance which would make it more popular and divest it of many onerous conditions which had grown up in the past; and the ambition of individual propagandists to extend the blessings of life assurance began to be stimulated in a way then altogether unprecedented. The method of accumulating dividends of profits for the benefit of persisting policy-holders during long periods, thus making an advantageous offset to the burden of long-continued

payments of premium, became one of the features of American life assurance, and appealed naturally and successfully to the keen American mind.

It was formerly the custom, not only in Europe, but in America, for life companies to keep the widows and other beneficiaries of deceased policy-holders waiting for periods varying from three to six months after the death of the bread-winner before the money on the policy could be availed of, while lawyers searched for reasons to escape payment. In America this practice has become almost a dead letter. Companies which do not unhesitatingly pay at once upon the death of the assured cannot hold their own in competition. One company advertises every year the promptness with which its claims have been paid, showing in 1899, for example, that nearly eighty per cent. of its death losses were paid within a day after the proofs of death were submitted, and more than eighty-five per cent. of the whole within three days thereafter.

Another concession of American companies to the rights of the assured has been what is known as the "incontestable feature," by means of which the company estops itself from making any resistance to the policy on any ground whatever, except non-payment of premium, after it has been in force for one year. This has been one of the most radical, and at the same time reasonable, reforms in American life assurance. It has abolished all that narrow quibbling which too often characterised the action of life assurance companies in former times, and has placed the responsibility on the companies of discovering frauds and mistakes within a brief period after the assurance is issued, and usually during the lifetime of the party most concerned.

Space does not admit of a further pursuit of this examination. The healthful innovations brought about by rivalry in competition have been so numerous and so

important as to make the policies of American companies extremely attractive, even to those living in foreign countries, and it is a tribute to the enterprise and skill of American life underwriters that several of them have "carried the war into Africa," so to speak, and established their business in Great Britain, Germany, France, Russia, Spain, and, indeed, in all distant lands. The three largest companies of the United States have for many years been transacting business in foreign countries, and had assurance in force in these countries at the end of 1899 amounting to $683,513,602.

American life assurance is to-day on a footing as firm as that of any business in the world. There are degrees, of course, of excellence represented in the management of American companies, but taking not only the more successful but the average of the institutions, it may be confidently asserted that no safer or more carefully conducted financial enterprises exist.

The number of persons holding policies in the American companies of all kinds at the present time is probably upwards of 11,000,000. Of these, say, about one and a quarter per cent., or 137,500, may be taken as the number dying in a year. Taking five persons as the average number in each family, there would remain an average of four beneficiaries on the death of each person assured, or about 550,000 persons in 1899 benefited by the payment of about $133,000,000 in death losses by all the companies. As a means of distributing wealth, and protecting the unfortunate at the cost of the more fortunate, nothing could be devised which would more nearly approach the ideal than the system of American life assurance. And all these figures are annually increasing.

There are probably more than 20,000 men and women making their living as agents in propagating the business of life assurance in the United States. These industrious people are veritable missionaries for the highest good,

and in these days when there is so much discussion as to the most feasible way of arresting poverty and encouraging thrift, the study of life assurance as practised in America by the companies which have worked out such an example to the world would repay the time and attention given to it on the part of every intelligent citizen who loves his country and his kind.

The fact that life assurance has under its protection millions of widows and orphans who for the most part have no other dependence and are naturally incompetent to judge for themselves, lends a sacred character to the business. The mind directing such an enterprise which will stoop to the meanness of vulgar rivalries or hazard the permanent advantage of policy-holders by excessive concessions from sure principles, in order to outstrip a competitor, has no place in the councils of this solemn and stupendous institution.

CHANGES IN THE LEGAL AND POLITICAL STATUS OF WOMAN

By Julia Ward Howe

OF all the anomalies which the progress of civilisation presents, none is more wonderful than the history of women. Long held as an article of barter and trade, considered even in our own time rather as something to be possessed than as capable of possessing, the sex has yet, in the persons of individuals, been beloved, honoured, idealised, crowned, and worshipped. The Christian dispensation has made woman a partaker in the great things of human destiny. Modern democracy has found it impossible to exclude her from its benefits and dignities. Finally, in a country in which education has come to be recognised as the only safeguard of public institutions, the privileges of instruction have been fully secured to her, and the immunities of ignorance have ceased to be considered as her peculiar perquisite.

This progress, slow in its inception, long continued to be almost imperceptible. We may even say that at the beginning of the nineteenth century the legal position of woman was one of passive endurance. In privileged circles and among good people this was not often nor generally realised; but where manners were rude and where the limitations of poverty were felt, wives and daughters became painfully aware of their pitiful condition before the law. Mothers did not own their children, nor the very garments which they wore. Any money that a married woman could earn or inherit became the

property of her husband, and could be taken to pay his debts. In most departments of labour, moreover, a discrimination was made against women workers, and in the few employments in which they competed with men they received for the same service a much smaller compensation. At the time referred to, and for years afterwards, a married woman could neither make a will nor enter into a contract without her husband's consent. In the administration of the great interests of the community she had no part and no voice.

I wish that it were in my power to present a picture of the absolutely extralegal and extrapolitical position of the female sex at the beginning of the nineteenth century, in contrast with a clear impression of the almost miraculous changes shown in its present condition. The process which has effected these changes has been slow and gradual. The great lesson of justice irrespective of sex has been taught, line upon line and precept upon precept. The advocates of that justice have been met as enemies and outlawed as quasi-criminals by the very class of persons which they were determined at all costs to deliver from a barbarous oppression, made tolerable only by a growing disregard of the laws that sanctioned it.

A writer in the *Evening Post* some years ago, speaking of the opposition of many women to woman suffrage, remarked that it was strange that the sex at large should appear to be so little grateful to their would-be benefactors, if the advocates of suffrage really deserved to be so called. I longed to remind him at the time that the Founder of our Christian religion more than once spoke of Himself as in line with those prophets of the better way who had all been slain by those to whose need they came to minister.

Mary Wollstonecraft, in the late eighteenth century, and Frances Wright in the early nineteenth, began to agitate the theme of woman's rights. The expression

became at once a synonym for all that is considered unlovely and unfeminine. The advocates of the new theory, few in number as they were, were forced into a position of social isolation, in which they were commonly supposed to seek the eccentricity which was the inevitable result of the treatment received by them at the hands of the community.

After the great liberation brought in view by the teachings of Christianity, the woman-world owes its first emancipation to the Society of Friends, in which were proclaimed the spiritual equality of men and women, and the right of the latter to be recognised as teachers of religious truth. Accordingly, we find Lucretia Mott present at the memorable convention in Seneca Falls in 1848, the first convention held in this country for the consideration of the civil and political rights of women. In this meeting Elizabeth Cady Stanton took a prominent part. With her appeared Frederick Douglass, gifted with so just a notion of the nature of freedom as to regard it as a right of white women as well as of coloured men.

The anti-slavery agitation, indeed, carried the woman question along with it in its progress. When its culmination was reached, the champions of the slave became, with few exceptions, the advocates of a freedom which should know no limits either of colour or of sex. The exigencies of our Civil War brought numbers of our educated women into close and sympathetic relations with each other. They found themselves constrained to act in concert for the relief of the soldiers, for field and hospital service, and for the providing of necessary comforts for the sick and wounded. From this wider outlook the women never went back. The awful experience, too, of the war suggested to them many questions not to be answered by the old methods of reasoning. This terrible war took from many of them what they held dearest on earth — husbands, lovers, brothers, sons. Were they

always to sit patiently beneath these heavy burdens of sorrow, imposed from without, with no consent of their own? Did not the question of war and peace concern them as deeply as it could concern the men of the country? It is scarcely necessary to rehearse here the great names which inscribed themselves under the new banner. They were names ever to be held in honour in our country's record, and they represented no half-hearted allegiance to the new reform. William Lloyd Garrison, Wendell Phillips, George William Curtis, Henry Ward Beecher,—let the opponents of woman suffrage consider what these names meant to the community, what they still mean to history. Side by side with these brave men stood a young woman who argued the cause of her sex with a fresh charm and a new power. Lucy Stone, a farmer's daughter, had by long and patient labour enabled herself to acquire a college education. Gifted with a pleasing presence, a beautiful voice, and great force of conviction, she turned easily from the labours against slavery and intemperance, in which she won her early laurels, to the new advocacy which was destined to metamorphose the position of woman throughout the civilised world. In her husband she found a congenial and faithful helpmate. The pair, at first resident in New Jersey, transferred their household belongings to the neighbourhood of Boston, from which point they unweariedly visited every part of New England, and much of the far West, pleading everywhere, with eloquent tongues, for the civil and political enfranchisement of women. Then arose pleadings which voiced the complaint of many hearts. Reason, the supreme authority, became convinced. Women said: "It is not right that men should be the sole arbiters of our fortunes. We, as well as they, are guardians of the community. We, with them, must have a voice in its affairs."

I had the happiness to become associated with these

friends in their work, and to accompany them on many of their journeys. From these I reaped the benefit of an extended acquaintance with my own country and its people in various ranks of life. At intervals we made a thorough visitation of towns in New England, and especially in Massachusetts. We spoke oftenest in churches, but sometimes also in halls and schoolhouses. In the smaller places we held our meetings in the afternoon and evening, the women being too closely occupied with domestic matters to leave their homes in the forenoon. In the larger towns, teachers, factory hands, and schoolchildren formed part of our audience. Mrs. Livermore, then newly arrived from the West, was with us on these occasions, Colonel Higginson sometimes, Mr. Garrison often. I recall with pleasure a suffrage campaign which we made in the State of Vermont a score or more of years ago. The time was midwinter. As we whirled through the superb forests, the trees glittered as if every branch had been hung with diamonds. The air was crisp and exhilarating. We were the recipients of much simple hospitality, and our meetings were largely attended. Maine and New Hampshire also received us gladly. In the first named of these States farmers' wives sometimes drove thirty miles in an open wagon, and in zero weather, to hear our speakers. More than one of these confided to Mrs. Stone their sense of the dreariness of their lives, the sordid cares, the almost hopeless outlook, as the very home which they had worked hard to buy and to keep would in all probability be willed away from them by their husbands.

A very important part of the advance now noticeable in the legal position of women in Massachusetts is due to the legislative hearings which have been granted to the petitioners for woman suffrage during a long period of years. These hearings naturally were occupied by the prime matters of debate. At the same time, the exposure made of the legal and economic injustice suffered

by women did much to stimulate legislative action in their behalf. In the legal profession itself we had some important allies. One of the most efficient of these was the late Samuel E. Sewall, a man greatly beloved and honoured in his day. This good friend devoted much time to the devising of bills for the amelioration of the legal condition of our sex. Among these I recall the following: A bill enabling a married woman to make a business contract with her husband; one allowing her to make such a will as she should see fit; one giving her a right to her own clothes; one securing to her the right to be buried in the burial-lot of her deceased husband; a bill for the abolition of the widow's quarantine, *i. e.*, of the law which forbids her to remain more than forty days in the house of her deceased husband without payment of rent, the right of the husband in corresponding circumstances being without legal limit. An important measure was brought before the Legislature of Massachusetts by the Home Club of East Boston, seconded by the New England Women's Club of Boston. This was a bill ordering that men who walk the streets of cities at night with evidently vicious purposes should be liable to arrest and penalty equally with women of like character and purpose.

I have often heard Mrs. Stone plead with great feeling for the right of married women to the equal guardianship of their children. I find upon examination that there are but eight States in the Union in which they enjoy this right, and that Massachusetts is not one of the eight. A very general interest was felt some years ago in Massachusetts regarding what is called the age of consent for young girls. This was first fixed in that State at ten years: it has been gradually extended to sixteen years, which limit was reached in 1893. While this was still a vexed question, I attended a hearing at the Boston State-house in behalf of this very important change.

Prominent among the speakers was the Rev. James Freeman Clarke, whose remarks were ably seconded by those of his daughter, Miss Lilian Clarke. Mr. Clarke argued that, since the law decided that a woman could not be held responsible for the management of her property before the age of twenty-one years, it could hardly be believed that the same law held her responsible at the age of twelve or fourteen for matters which would decide her character and fate for life.

The band of suffragists who for many years have brought their own and kindred reforms before the legislators of Massachusetts have, upon occasion, brought with them eminent lawyers of the other sex: the Hon. Samuel E. Sewall, George S. Hale, and others. It was a pleasant addition to our force when a pretty and well-dressed young lady, in full legal practice, came with us to a committee hearing at the Boston State-house. On one such occasion several members of the committee expressed the opinion that we in our plea had overstated the undesirable features of the law under consideration. Miss ——, with sweet voice and charming modesty of manner, said: "Gentlemen, if you will look into volume — of the State Statutes, page —, you will find that the matter stands as we have stated it." The volume was examined, and our statement was thereby confirmed.

Connecticut has the credit of having been the first State which gave to married women the power to make a will. This power the State conferred by Act of Legislature in 1809. Ohio followed twenty-six years later, in 1835. In 1836, an endeavour was made by Ernestine L. Rose and Paulina Wright Davis to circulate in New York petitions for property rights for married women. They met with but little success, women and men alike deriding them. Mrs. Rose, however, addressed the Legislature of Michigan, asking for the political enfranchisement of women. This is said to have been the first address given

by a woman before a legislature. In the same year, Abraham Lincoln made a public declaration of his belief in the propriety of giving the franchise to women, an act which did not interfere with his election, some twenty-four years later, to the office of chief magistrate of the United States. In 1837, a National Female Antislavery Association held a convention in the city of New York. This appears to have been an entirely new departure for the sex. Angelina Grimké, a Southern lady, who had freed her own slaves, was mobbed in Independence Hall, Philadelphia, for speaking in public against slavery. The Grimké sisters became well known as advocates both of negro emancipation and of the political rights of their own sex. In their State they had enjoyed the consideration insured by fortune and position. When they entered upon their new mission at the North, they became *anathema maran atha* to all save a few elect spirits. Their labours and those of Abby Kelley Foster and others in behalf of women soon began to bear fruit. In the years that followed, the public conscience became more and more exercised regarding the rights that women should enjoy in a free country. Legislative hearings in their behalf multiplied, and State after State relaxed the rigour of its exclusions.

In 1840, Texas gave married women the right to make a will. Alabama did likewise in 1843, Vermont in 1847. In 1848, the State of New York secured to its women the control of property. Pennsylvania added to this the power to make a will. In this year was formed the first local suffrage association, at South Bristol, N. Y. In 1849, Virginia conceded to wives the right to make a will. Massachusetts gave both powers in 1855, Rhode Island in 1856, Maine in 1857, Wisconsin in 1859, Maryland in 1860. At the time of writing there remain only seven of our States in which women do not enjoy some control of their property.

It would seem that the leaven of a new faith had been working in the community from the early years of the nineteenth century. This leaven, as was natural, was generated in the minds of men and women eminent in the domain of literature and recognised as leaders in thought. In 1810, the Rev. Sydney Smith made, in the pages of the *Edinburgh Review*, a witty and eloquent appeal for the better education of women. Margaret Fuller, who was born at about this time, devoted the fulness of her remarkable powers to the advocacy of human rights, and pleaded earnestly for the enlargement of education and opportunity for her own sex. In 1852, Mrs. Stowe, by the publication of *Uncle Tom's Cabin*, placed herself in the forefront of the battle against slavery, and revealed to the reading public a power not previously recognised in her sex,—that of setting whole communities aflame with indignation against one form of tyranny. In 1854 Florence Nightingale's energetic services in the Crimean War shed a new lustre upon the annals of her sex. In 1867, John Stuart Mill, eminent as a philosopher and political economist, pronounced in the English Parliament a memorable speech in favour of full suffrage for women.

To return briefly to the record of the States,—the vigorous young Territory of Wyoming, at the first session of its Legislature, in 1869, granted full suffrage to women. When, twenty-three years later, the Territory was admitted to Statehood, its delegates insisted on maintaining in its constitution the right of women to suffrage, and, refusing to enter the Union upon any other terms, carried their point. Municipal suffrage was granted to the women of Kansas by Act of Legislature in 1887. Finally, but not, we hope, to conclude, Colorado in 1893, and Utah and Idaho in 1896, bestowed upon the women within their bounds suffrage full and equal to that exercised by men.

I must say a word here about the new power of eloquence displayed by women when they became persuaded that they had a cause to plead. The walls of public buildings all the country over rang with their appeals for a better administration of justice, a fairer distribution of the functions of society. Mrs. Stanton, the Rev. Antoinette Brown, Susan B. Anthony, Mrs. Mary A. Livermore, and other courageous women spoke in public for reform. Anna Dickinson electrified audiences with her stirring words. Frances Willard won great multitudes to the cause of temperance. Conventions and congresses of women were held, in which the burning questions of the day were discussed from the woman's point of view. Kansas, Wyoming, Iowa, Colorado, heard the new gospel of women's hope — heard and heeded.

The power of associated action among American women has been greatly promoted by an agency scarcely dreamed of fifty years ago,—that of the women's clubs. The time for these had come in the world's economy, and almost simultaneously in two of our leading cities appeared the New England Woman's Club of Boston and the New York Sorosis. Until that time the word "club" was commonly understood to indicate a place, more or less convenient and elegant, where the men could meet together for purposes of business, amusement, or friendly intercourse. The first women's clubs were started with the view of affording their members a more sympathetic and profitable communion than that conceded by fashion. The work of these clubs was to be the study of important social questions and the earnest endeavour to promote their true solution. Their recreations were to be furnished from the resources of art and literature. With several of these pioneer groups of students and workers I have had the honour to be closely associated. One of them, the Association for the Advancement of Women, originally founded by the New York Sorosis, devoted its

energies to the holding of an annual congress of women in various parts of the Union. Wherever those meetings were held numbers of women, usually held apart by personal affairs, came together to welcome the pilgrims who had journeyed from afar. The congress lasted three days, and its sessions were devoted to the discussion of the most important and timely topics. The welcome given to its members, sometimes rather dull and tardy, always warmed into grateful praise. Helpful groups of workers everywhere sprang up in its tracks. When, more than a score of years after its beginning, Sorosis issued a call for a convention of women's clubs, a multitude appeared at her bidding, and a federation of women's clubs was formed which now binds together in amity the women of our whole domain, from Maine to Louisiana, from Massachusetts to California. The results of this wide extension of intercourse between different regions of our country can hardly be overestimated. Under its influence, sectional differences lose their unfriendliness of aspect, and sympathetic accord in the pursuit of worthy objects oversweeps and harmonises all petty and personal discords.

In what I have already written I have characterised the apparently hopeless outlook of the sex which prevailed, let us say, until the middle of the period under consideration. I have tried to illustrate the steps by which a helpless ward of the law has already become one of its active agents, sharing in some States the full responsibility of legislation. In the first half of the century there were some seven occupations open to women. The last report of the Commission of Labour enumerates three hundred honest ways in which they may gain a livelihood. In the earlier period free speech was denied to women by the great power of public opinion. The editor of the *Springfield Republican*, adjuring Lucy Stone not to speak within the limits of his town, addressed her

as " You she-hyena." To-day, the honours and opportunities of the platform belong as fully to women as to their brothers. They are not only permitted, but urgently requested, to use their gift of eloquence in behalf of the most important questions which come before the mind of the community. The very thought of conceding to women a vote on any matter of public interest was derided as ridiculous and intolerable. They have now the right of school suffrage in twenty-two of our States. In four States full suffrage is secured to them; in one, municipal suffrage.

Although Massachusetts does not lead in the march of woman's political advancement, she has been a strong centre of influence in the progress of the sex. She was first to concede to women the right not only of voting in the election of the school board, but also that of membership in that important body. The question of school suffrage was first brought forward in Boston by Abby W. May, and the New England Woman's Club, of which she was a beloved officer, was the arena in which were heard the first arguments on the subject. In this same club, one of the earliest formed in the country, many matters of public interest were presented to the consideration of a wide circle of intelligent women. Dress reform, public sanitation, improved dwellings for working people, the beneficent providing of country and seaside outings for the children of the poor — these and other kindred topics were ably presented to the club, many of whose members became actively engaged in promoting the measures just spoken of.

The present state of things leaves us much to hope and work for, but the end, albeit not attained, is yet well in sight.

WOMEN IN THE INDUSTRIES AND PROFESSIONS

By Caroline C. Catt

AT the opening of the nineteenth century the position of women, as prescribed by law and custom of the civilised world, was that of complete tutelage to fathers, husbands, and sons. The rehearsal of the laws of the period conveys but slight information concerning the limitations imposed upon women, for the unwritten laws of public opinon were often quite as binding; yet clearly to comprehend the significance of the changes in the position of women which have been wrought in the nineteenth century it is necessary to understand the point of departure.

In 1800, the spinster over age and the widow were free by law to collect their own wages and to control their own property, but popular opinion restricted this right. The nearest male relative usually managed the property of such women, and the custom was so thoroughly established that few women dared to become the exception to it. The opinion was likewise widespread and emphatic that no man of pride and resources would permit his womenfolk to labour for money, and the natural corollary of that opinion was another — that the woman who laboured for wages was to be pitied as an unfortunate or disapproved as an eccentric. In consequence, many women whose freedom from family cares and natural instincts urged them to enter the field of labour ate the bread of dependence rather than face the condemnation

of society. The fact that food and clothing were almost wholly prepared within the home rendered this condition possible and bearable, since such useful and necessary employment was furnished that the dependent relative could more than pay for her keeping by the value of the services she rendered. Women driven by necessity into the world's workshop found few occupations open to their hands, and these so poorly compensated as to offer little more than a bare subsistence. The paid work of women outside was necessarily pitted against the unpaid work of women within the home; while the unrecognised commercial value of both tended to strengthen the opinion generally adopted that women's work was always of an inferior quality.

When Harriet Martineau visited the United States in 1840, she reported having found only seven occupations open to women,—teaching, needlework, keeping boarders, working in cotton factories, typesetting, bookbinding, and household service. Of these employments, teaching indicated the highest mental acquirements, but at that date women teachers were confined almost entirely to the primary departments of city schools and to summer terms in country districts. The lack of opportunities for higher education prevented their fitness for the highest positions, and the popular idea of their general incompetency prevented the full recognition of the qualifications they did possess. A dollar a week with " boarding around " was accounted good wages for a woman teacher.

The economic development of the country was the unconscious influence which brought better industrial conditions to women. The establishment of factories gradually removed the manufacture of cloth and clothing from the home. The necessary purchase of these necessities demanded a greater cash income for the family. The man who had supported a family of women when it required but small outlay of money, found himself unable

to do so when every comfort demanded a cash investment. The necessities of poverty drove women into the wage-earning occupations, while the changed economic conditions gradually lifted the ban placed upon the woman worker. Meanwhile, the prejudice against education for women was being slowly eradicated, and better opportunities were offered for their intellectual development. With higher qualifications, there came the demand for better-paid employments, and the gradual opening of new occupations followed.

The real contest centred about the three learned professions, since the opposition there combined the prejudice against the woman worker, the prejudice against financial independence for women, and the scepticism concerning woman's intellectual ability. This portion of the history of the industrial evolution of women offers the truest measure of changed conditions. In the early years of the century the higher vocations were entirely beyond the reach of women. Three distinct and overpowering obstacles stood in the way:

(1) The belief, practically universal, that the minds of women were wholly incapable of mastering a college education, and still less the training required by a learned profession; and that their physical strength was insufficient to endure the strain of so long a period of close study. (Oberlin College was opened in 1833, but no women were graduated until 1841.)

(2) The belief, quite as universal, that if a woman should receive the necessary professional training, no patrons would reward her, and her preparation, in consequence, would represent a loss of time and money.

(3) The popular belief that any woman who would seek to enter a profession must of necessity be masculine, "unsexed," indelicate, and unworthy of public esteem.

The first profession opened to women was medicine.

The first graduated woman physician was Dr. Elizabeth Blackwell. She was born in England, but had removed at an early age with her family to America. She was a woman of clear intellect, austere character, and resolute courage. She was poor, and no friend stood ready to supply the necessary funds to secure the required training. Nothing daunted, she began teaching, and by dint of constant energy and close economy for a period of years she saved a sum accounted sufficient for a beginning. Meanwhile, she had sought advice and counsel of many physicians. Many condemned her ambition as unsuitable and unwomanly, a few wished her well, but none had definite counsel to offer. Arrangements were finally made whereby she might study in the office of a physician. Afterwards she made application for admission to different medical schools, but the invariable answer was a peremptory refusal. A professor of surgery in the largest college in Philadelphia, who was favourable to Miss Blackwell's enterprise, offered to admit her to his classes if she would disguise herself in the attire of a man. Still another friend advised her to don male attire and go to Paris for study; but neither proposition tempted her. In her own words: " It was, to my mind, a moral crusade on which I had entered, a course of justice and common sense, and it must be pursued in the light of day, and with public sanction, in order to accomplish its end."

Among the colleges to which she sought admission was one at Geneva, N. Y. The faculty passed upon her request and concluded not to admit her, but, wishing to escape the full responsibility of a refusal, decided to leave the matter in the hands of the class, with the understanding that, if a single student objected, she should be excluded. In the words of a member of the class and an eye-witness,

Contrary to all expectations, the whole affair assumed the

most ludicrous aspect to the class, and the announcement was received with the most uproarious demonstrations of favour. A meeting was called for the evening, and every member attended. The resolution approving the admission of the lady was sustained by a number of extravagant speeches which were enthusiastically cheered. The vote was finally taken with what seemed to be one unanimous yell, "Yea!" When the negative vote was called, a single voice was heard uttering a timid "No!" The scene that followed passes description. A general rush was made for the corner of the room which emitted the voice, and the recalcitrant member was only too glad to acknowledge his error, and record his vote in the affirmative.

The faculty received the decision of the class with evident disfavour, but were compelled to return an answer admitting the applicant. It appeared later that some of the students considered the application a hoax perpetrated by a rival institution.

However, when Miss Blackwell appeared, her fellow-students conducted themselves with entire decorum and respect. She entered in 1847 and graduated in January, 1849. The President of the college pronounced her the leader of her class, and stated that she had passed through a thorough course in every department. Her graduation made a profound impression upon the public. The press received the news of a woman graduate in medicine with varying comments. Many writers displayed their bitter disapproval, a few gave words of cheer, but the majority treated it as a joke. After graduation, she pursued additional studies abroad. In 1850, after repeated endeavours to gain admission to St. Bartholomew's Hospital, she was admitted with the information that every department would be open to her "*except the department for female diseases.*" Dr. Blackwell returned to America and began to practise in New York in 1851. She reports the first seven years as difficult and discouraging. In her own

words: " I had no medical companionship, the profession stood aloof, and society was distrustful of the innovation. Insolent letters occasionally came by post, and my pecuniary position was a source of constant anxiety."

In 1854, Emily Blackwell, a sister of Elizabeth, graduated from the Medical College of Cleveland, and continued her studies in Paris. Maria E. Zackrewska, a young German woman, who had begun her studies in her own country by the advice of a prominent university professor, came to America to find opportunity to complete them. This she did at the Cleveland College. These three women established a hospital in New York in 1857. The attempt met with much opposition, and the promoters were assured

that no one would let a house for the purpose; that " female doctors " would be looked upon with suspicion; that the police would interfere; that if deaths occurred their death certificates would not be recognised; that it would be resorted to by classes and persons whom it would be an insult to be called upon to deal with; that without men as resident physicians they would not be able to control the patients; that if any accident occurred, not only the medical profession, but the public, would blame the trustees for supporting such an undertaking; and, finally, that they would never be able to collect money enough for so unpopular an effort.

No obstacle had been so serious as the one which now faced these three courageous women. Unfortunately, although women had been excluded from medical schools, there had been occasional women who took the title of " doctress " for the purpose of a criminal but profitable practice. Not only had the first women physicians to battle against the prejudices of society, but they were forced to contend against the suspicion that the woman practitioner was a disguised criminal. Perhaps nothing could more clearly demonstrate the effect of this belief

than an incident related by Dr. Elizabeth Blackwell. She had called upon Fanny Kemble, who was giving a series of Shakespearian readings in New York, often in aid of struggling institutions. The actress listened courteously until she heard that the physicians of the institution seeking her support were women, when " she sprang up to her full height, turned her flashing eyes upon us, and with the deepest tragic tones of her magnificent voice, exclaimed: ' Trust a *woman*—as a *doctor! never!* ' " The difficulty, however, was overcome, and the Infirmary for Women and Children was established, where thorough training for female nurses was given.

Various female medical colleges opened meantime, and a number of women availed themselves of the opportunities thus offered. Among these were colleges in Boston, New York, and Philadelphia, each sanctioned by the Legislatures of their respective States. These colleges, however, owing to public opposition and a meagre attendance, did not reach the high standard maintained by the best colleges for men. Many women graduating from them were forced to go to Paris, London, or Switzerland for the opportunities of advanced study which were denied by American colleges. The difficulties which hindered the practice of those early women physicians almost passes belief. In Philadelphia, in 1850, Dr. Hannah Longshore opened an office, only to find that the men physicians were in league against her and that, at their request, the druggists of the city refused to sell drugs to her, hoping by such action to drive her from the city. In many States women were denied admission to medical societies, and many physicians refused to consult with them.

In 1861, the study of surgery and dentistry was opened to women in Sweden, and in 1863 the University of Zurich opened all its departments, including medicine, to women. In 1865, Miss Elizabeth Garrett received the

first medical diploma granted to a woman in England. In 1869, women were admitted to the academic departments of the University of Michigan. It was twenty years since the first woman had graduated in medicine, and a significant change in public sentiment had followed, yet when a leading professor in the School of Medicine at Ann Arbor was asked if women were admitted to the medical department also, he gave back the vulgar but suggestive reply: "No, thank God! they can only enter there in the pickling vat." Yet a few years later they were admitted to the medical department.

For many years medical practice of a desirable kind was difficult for women physicians to secure. Patients came at first chiefly from the poor. Women who should, according to theory, have been the best patrons of their pioneer sisters, were influenced by popular opinion and offered neither support nor encouragement. The prejudice which was overwhelming in 1840, has not been entirely eliminated; yet at the close of the century women are admitted to the medical societies of the United States and England, are accepted in consultation with men physicians, and the practice of many of them is large, successful, and lucrative. At the close of the century there are in the United States and Canada forty-nine medical colleges admitting women, nine being separate women's schools. Seven hundred graduated women physicians are reported as practising in Russia, several hundred are practising in the British Empire and colonies; there are women physicians in all countries of Europe, in China, Japan, Persia, India, and Egypt; and it is estimated that some ten thousand graduated women physicians are practising in the United States.

In 1850, Antoinette Brown was graduated from Oberlin, and immediately made application to enter the theological department. The President did his utmost to dissuade her, but failing in this he was forced to admit her,

owing to the exceedingly liberal character of the college charter. She pursued the entire course, and, despite the fact that faculty and trustees continued their disapproval of her presence there, was graduated with honour in 1853. However, to guard against further applicants the Oberlin charter was so amended as to prevent other women from entering the theological school, and her name was not printed in the list of graduates until forty years after her graduation. Miss Brown was, shortly after her graduation, ordained by a Congregational church in New Jersey. At about the same date, the Universalist Church ordained the Rev. Olympia Brown. Some denominations did not require a diploma from a theological school as a qualification, and on that account offered easier means of entrance than others; but this advantage, open to men, offered no encouragement to women, since it was offset by the overpowering belief that the ministry of women was contrary to God's Word. There are now some eighteen denominations, including Friends and the Salvation Army (which do not require ordination), that permit women to preach. Several hundred women are occupying regular pulpits. Those churches whose government is determined by large representative bodies, such as the Methodist Episcopal Conference and the Presbyterian Assembly, have never granted ordination to women. The denominations in which ordination may be secured at the request of a single congregation are those in which women ministers are most numerous. The so-called liberal denominations—Unitarian and Universalist—have ordained the largest number of women in proportion to their total membership. Among the churches which have ordained women are the Unitarian, Universalist, Congregational, Baptist, Free Baptist, Methodist Protestant, Free Methodist, Christian, and United Brethren.

The law was the last profession to admit women, and

it will doubtless be the last to concede fair opportunity. Yet the opposition is disappearing, the number of women lawyers is increasing, and sooner or later the law, too, will unquestionably offer equal chances to women. Permission to practise law in nearly all countries can be obtained only by decree of a court. In several States, courts threw off the responsibility of passing upon the application of women candidates by the decision that a special Act of the Legislature must first be secured, making women eligible to the profession of law. In 1869, Belle Mansfield was admitted to the bar in Iowa; that same year, Myra Bradwell made application for admission to the bar in Illinois, and was refused. She appealed to the Supreme Court of the United States, which decided that each State must determine the question for itself. Several women are now practising law in Illinois, and many States have admitted them to practice; but in each State a special effort had to be made to secure the right for the first candidate. Western States presented little difficulty, but Eastern States withheld the privilege longer. Several hundred women have since been graduated from law schools, and many are engaged in honourable and lucrative practice. Women have been graduated in law in several foreign countries, but although efforts to secure admission to the bar have been made in Italy, Belgium, Switzerland, and Russia, they have thus far been in vain.

Although woman in the "learned professions" still has difficulties to overcome in addition to those which confront man, it is evident that these are growing fewer every year. Basing one's judgment upon the rapidity with which conditions have changed in the last fifty years, a prophecy may be ventured with safety that in a few years the professional woman and professional man will stand before the world with equal chances of success or failure. The constantly increasing demand of women

for work, the gradual decrease of prejudice against the woman worker, and the improved standard of qualification have opened nearly all occupations to women, and all the professions, learned and otherwise, within the last fifty years.

No occupation illustrates more clearly the immensity of the changes wrought than teaching. As early as 1789, women were beginning to teach in country districts, in the summer months, when the schools were small and mainly confined to girls. The wages were much below those paid to men, even for summer schools, while winter schools, attended by boys, were considered quite beyond the capacity of women. The change of opinion has been slow but decided. In some States four fifths of the teachers are women, while for the whole United States more than half the teachers are women. Most Southern States still employ more men than women teachers, but Northern and Western States employ more women than men. In 1880 there were 100,000 women teachers in the public schools of the United States; in 1890, 236,912. The highest positions are usually reserved for men, and there is still unequal pay for equal work in most States. Many professorships in colleges and universities, representing every phase of scholarship, from ancient languages to modern science, and from literature to engineering, are held by women. The profession of teacher is also open to women in foreign countries, though they are mainly confined to positions in primary and intermediate schools. There, as in the United States, teaching was the first profession to admit women. The universities of Sweden, Italy, and Switzerland have employed women in responsible positions as instructors.

During the century there has been a marvellous growth of manufactures in the United States, and women as well as men have reaped the advantage. The censuses for 1880 and 1890 name 388 distinct occupations, exclusive of

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clerkships, in connection with manufactures, and women are reported to be employed in 371 of these. It is interesting to note the manufactures where no women have as yet been employed: Foundry supplies, artificial fuel, grindstones, horseshoes, iron and steel doors and shutters, lard oil, neatsfoot oil, resin oil, racking hose, beet sugar, zinc, and preserving wood. In the various industries 846,614 women are employed, as compared with 3,745,123 men. The number of women reported in the census of 1880 as engaged in gainful occupations was 2,647,157; in 1890, 3,914,571, and it is probable that the census of 1900 will report five millions so engaged. In 1880, 14.69 per cent. of the total female population was engaged in gainful occupations; in 1890, 16.97 per cent., or a little more than one woman in six.

Victor Hugo predicted that the nineteenth century would be known as Woman's Century. The comparison of the woman of 1800 with the woman of 1900 offers abundant proof of the correctness of the prophecy.

LITERATURE AND THE FINE ARTS

AMERICAN LITERATURE IN THE NINETEENTH CENTURY

By W. G. Trent

TO say that the year 1801 saw the United States almost destitute of imaginative literature worthy of the name — that is, of De Quincey's "literature of power" — is by no means an exaggeration. Certain rude beginnings in the art of writing poetry and fiction had been made, but the only two colonial writers who can justly be called great—Franklin and Edwards—had won their fame along quite different lines. The Revolution gave, of course, a great stimulus to the intellectual activity of the colonists, yet it is the publicists of the epoch that we still read, not the poets. Trumbull and Hopkinson are not precisely forgotten, but it is Jefferson whose writings are made the basis of a monumental cyclopædia. So it is with individual books. Crevecœur's *Letters from an American Farmer* and the *Federalist* have survived ponderous epics.

Yet the initial year of the century, if it witnessed in letters no such revolution as it did in politics, was not without signs that the reproach of literary sterility would soon be taken away from the young republic. In 1801 Charles Brockden Brown followed up *Wieland*, *Ormond*, and *Arthur Mervyn* with no less than three stories, and proved himself to be practically our first novelist of sustained power and our first self-supporting man of letters. In the same year the *Evening Post* was founded, while in Philadelphia the Addisonian Dennie preluded one of the greatest of

American literary achievements by establishing his (for the time) important magazine, the *Portfolio*.

Brown oscillated between Philadelphia and New York, and it soon became plain that the former city, which had risen to literary prominence since Franklin's advent, was to cease to be the country's intellectual, just as it had ceased to be its political, capital. Yet from the days of Brown to those of Dr. Weir Mitchell, it has always been the home of culture and of a considerable literary activity that is worthy of more attention than it usually receives. The Philadelphia magazines of the first half of the century were very influential, and at least one poet and dramatist, George Henry Boker, should have been more influential than he was. However this may be, it is surely to be regretted that the career, not merely of the first Philadelphian, but of the first American who made the profession of letters a success, should mean so little to the current generation. The proof-reader of a popular magazine insisted recently on setting the name of Charles Brockden Brown in quotation-marks, as though he were a forgotten novel, instead of an underrated novelist. The school of Godwin and Mrs. Radcliffe, to which Brown belonged, has deservedly passed away; but their American follower was himself a predecessor of Hawthorne and Poe, and a writer of marked, if crude, powers. Perhaps in the Elysian Fields he consoles himself for present neglect in his native land with the company of Shelley, who so heartily admired him.

The passing of Philadelphia's literary primacy was by no means evident during the first decade of the century, which is about as barren in great names, both in prose and verse, as the corresponding decade of the eighteenth was in England in the domain of poetry. John Marshall's *Life of Washington* (1804), and certain writings of William Wirt, " Parson " Weems, and David Ramsay, along with the lectures on rhetoric of John Quincy

Adams, and the earliest verses of Bryant, remind us that there is literary life throughout the whole far-stretching country; but the prospect is dreary enough, with a dreariness not much relieved by our glimpses of the familiar names of Lindley Murray and Noah Webster.

But in 1809 the pall lifts, for not only is this the birth-year of Lincoln, Holmes, and Poe; it is also the year of publication of the inimitable *History of New York*, by Diedrich Knickerbocker. In Irving, the American people found their first writer who really bade fair to be a classic. Even to this day it cannot be said with confidence that his style has been surpassed; and if his affiliations with British writers like Goldsmith are too close to suit patriotic critics, it is not clear that the man himself, the public, or the cause of literature can be held to have suffered greatly from the fact. In the light essay, in travel, in biography, and history he showed for fifty years — he died in 1859 — the affluent power of a master, while in the short story, in which his countrymen were destined to succeed so thoroughly, he shared with Hawthorne and Poe the honours due an originator. He soon had his disciples like Paulding, with whom he had begun *Salmagundi* in 1807, and was in every way the fitting head of the Knickerbocker school, the honours of which have been overshadowed but not eclipsed by those of the great New Englanders of the time.

The early plays of John Howard Payne, the murmurs of Washington Allston's mild muse, the first effusions of Pierpont and Mrs. Sigourney do not lend great interest to the next decade, but it is important to remember that in May, 1815, the *North American Review* was established at Boston, and that two years later it published the youthful Bryant's *Thanatopsis*. New England was coming to the front. Quarterlies were to be published throughout the country as far south as New Orleans, but

the Boston one was to be the longest-lived and the best. Bryant was to remove to New York, but the poetical genius of New England was to keep blooming for many a year. As for Bryant's own work, while it was destined to grow broader and more influential both in prose and in verse, especially in revealing those beauties of nature to which a utilitarian people were likely to be blind, it may be doubted whether as poet he ever surpassed the stately lines that brought him almost premature fame. Yet at least it was fitting that the morbid though powerful series of British poems, of which Blair's *Grave* is a typical example, should have culminated in the verses of a son of that New England which was the choicest creation of the Puritan spirit.

The names of Halleck and Drake are the next that attract us, and it is upon New York that their genuine if very mild lustre begins to shine (*The Croker Poems*, *Fanny*, 1819). The best poems of both are still familiar from our readers and anthologies, and surely both should live if only in the beautiful elegy devoted by the survivor to his friend. But a greater light was dawning. In 1820 Cooper published *Precaution*, and the next year he made up for his servile use of British models by giving to the world one of the most typical and excellent American novels of the century,—*The Spy*. The creator of Harvey Birch might be a follower of Scott, but he was also worthy to join the distinguished circle of great creators of characters. Two years later he published *The Pilot* and *The Pioneers*, the first in the noble series of romances in which he extended the domain of fiction over the sea, the primeval forest, and the prairie, and thus wrote the veritable American epic. In the breadth and general vigour of his literary achievements Cooper has, perhaps, been surpassed by no American writer. The inferior quality of some of his works and his artistic ineptitude whenever he is out of his two elements—the sea and the

forest — have diminished his reputation with the critics; but *The Leatherstocking Tales* are unimpeachable classics, and Cooper shares with Poe and Whitman the honour of being an author, not for America or the English-speaking peoples alone, but for the world.

The permanence of Cooper's fame suggests, by the law of contraries, the impermanence of Percival's, whose first verses were published the same year with *The Spy*. Percival took himself very seriously, like many another unformed writer of the time; he was taken seriously by his countrymen; but Lowell's severe essay finally put out a candle that was burning very dimly. Immaturity such as marks nearly every page of Griswold's pinchbeck treasury of our early verse was bound to characterise the rank and file of the writers of a country that was still colonial in spirit; and eventual obscurity is the fate of immaturity. We can therefore afford to pass rapidly over the third decade of the century, pausing only to mention the earliest work of Jared Sparks, George Ticknor, Lydia Maria Child, and Edward Everett,—all of whom were destined to win genuine distinction later. A word, too, must be given to Audubon and to Edward Coate Pinkney's small but true vein of lyric work, while it should not be forgotten that Poe's *Tamerlane* dates from 1827 and Hawthorne's *Fanshawe* from the next year. The decade ended with the *Miscellanies* of the elder Channing, some *Observations* by Bronson Alcott, and a text-book by Longfellow. It ended also with Webster's Reply to Hayne—that is, with the beginning of the triumph of the national idea and of New England's great share in that triumph.

The three decades that preceded the Civil War form as distinct a period in our literature as they do in our politics, and in both cases the dominating note was the cry for freedom. This is borne in upon us by the facts that in 1831 William Lloyd Garrison established the *Liberator*

at Boston, and that Whittier made his first appearance as an author the same year. *Legends of New England* was the title of Whittier's first book, and throughout his long life he remained the loyal son of his native section, and, as the author of *Snow-Bound* (1866), pre-eminently its laureate. But he was soon destined to exercise a national influence as an advocate of freedom, and if, as is not unlikely, this portion of his work declines in popularity as its subject recedes in the nation's memory, he will at least retain his fame as a great public servant and as a poet truly touched by fire from heaven.

A very different poet from Whittier, Nathaniel Parker Willis, was about this time illustrating the comparative decline of the Knickerbocker school. But Cooper's influence was still powerful enough to dominate rising talents throughout the country. By 1835 William Gilmore Simms of Charleston had written his *Yemassee* and his *Partisan;* John Pendleton Kennedy of Baltimore his *Swallow Barn* and *Horse-Shoe Robinson;* and Robert Montgomery Bird of Philadelphia his *Calavar* and *Infidel.* Fate has not dealt in an altogether kindly fashion with these good, though not great, romancers, but perhaps a slightly better day is in store for them. Meanwhile we must not forget that in this period of comparatively unread fiction and provincial annuals, such important works as Dunlap's *History of the American Theatre*, Bancroft's *History of the United States* (1834–1874), and Story's *Commentaries on the Constitution* were given to the public. Such names, also, as those of Jacob Abbott, the elder Dana, Charles Fenno Hoffman, and Miss Sedgwick remind us that a number of minor writers were busily emulating the achievements of their betters. Judge Longstreet's *Georgia Scenes* (1835) furthermore prepares us for the rise of that distinctively American humour which in our own generation has culminated in the great writer whom we continue to call Mark Twain.

But we must return to New England, where transcendentalism was breaking into flame. There is no space to discuss this important literary phenomenon (a fact the less to be regretted as Mr. Lindsay Swift's admirable *Brook Farm* is so recent a book). Still it may be remarked that a recoil — probably too violent — upon the inner self is a most distinctive feature of the transcendental movement, and that such a recoil was natural enough in the Jacksonian period, with its coarseness, its speculative greed, its jarring factions. What wonder that in such an epoch and in the years that followed it Emerson turned to nature and to the Oriental philosophers and poets; that Hawthorne lost himself in reconstructing the past of New England and in sounding the depths of the human heart; that Poe, lacking the Puritan environment to support him, peopled with shadowy figures an enchanted region set " out of space, out of time " ?

Emerson, Hawthorne, Poe,— this is the noble triad of writers that for us dominates the American literature of the golden age,— that is, of the mid-century. Whether the first-named holds and will hold his place rather as a guide to conduct, a moralist, than as a truly literary force — as Matthew Arnold seemed to think — is a question that cannot be discussed here; but no such question can arise in the cases of Hawthorne and Poe. *The Scarlet Letter* (1850) and *The House of the Seven Gables* are still unmatched, still retain their hold, even if *The Marble Faun* is losing its fascination. *The Raven* and its accompanying poems, *Usher* and its companion tales, still charm and enthrall the English-speaking world, and have conquered Europe as well.

But although these are the *dii majores*, there are *dii minores* that almost deserve translation to the higher spheres. There is Longfellow, whose purity and sweetness captured the entire nation and partly obscured the heroic note in some of his work, which, with his scholar-

ship and his metrical mastery, will probably serve him well with the more critical readers of the future. There is Holmes, the urbane poet and readily obeyed "Autocrat." There is Lowell, the master satirist of our literature, whose *Fable for Critics* and *Biglow Papers* in their way dominate the ante-bellum period as fully as his odes, his essays, his political utterances, dominate the closing years of the century. Beside these eminent men, and worthy of them, stands Thoreau, who was as much intoxicated with nature as Spinoza was with God. Nor must we forget those great historians who were also great writers, Prescott and Motley, nor their successor, who perhaps surpassed them, Parkman, the major portion of whose work, however, belongs to the period subsequent to the war. If American literature could boast of its historians only, it would still command respect, for from the days of Bancroft and Hildreth to those of Fiske and Rhodes the Muse of History has never lacked acceptable worship among us.

But the greater names must not entirely crowd out the lesser. Gratitude is still due to George Ripley for his services as an introducer of foreign literature and as a critic. In the latter capacity Margaret Fuller and her fellow writers of the *Dial* (1840) deserve more popular recognition than they get. The younger Dana is still remembered for his *Two Years Before the Mast* (1840), and the poems of Jones Very appeal to the ultra—I cannot venture on the obvious pun — elect. Theodore Parker has lately been fortunate in having Mr. Chadwick as his biographer, and in figuring in the interesting *Contemporaries* of Colonel Higginson, who, with Dr. Edward Everett Hale, continues to maintain the great traditions of New England. Herman Melville in *Typee* (1846) laid the foundations of a fame which, after some obscuration, seems likely to be permanent, in a genuine though limited sense. Other worthy names that appear in the period

between the Mexican and the Civil wars are those of Beecher, Bayard Taylor, Saxe, Donald G. Mitchell, Whipple, G. W. Curtis, Miss Alcott, John Esten Cooke, H. H. Brownell, T. W. Parsons, Richard Grant White, Hayne, Timrod, Parton, T. B. Read, Mrs. Howe, Stoddard, Palfrey, and Charles Eliot Norton,—all of whom survived the Civil War, and a few of whom remain to begin the new century. To this list must be added the name of Harriet Beecher Stowe, although the abiding merits and the world-wide fame of *Uncle Tom's Cabin* make one hesitate to exclude her from any enumeration of our major writers. Walt Whitman's *Leaves of Grass* (1855) dates also from this period, but his growing influence is a matter of later years, and he cannot now with fairness be ranked with any save our most powerful and original writers.

The decade from 1860 to 1870 was naturally not propitious to literature, but the veterans continued their work, and important new names emerged, such as those of Howells, Stedman, Aldrich, Henry C. Lea, John Burroughs, S. L. Clemens, Bret Harte, Lanier, John Fiske, and Frank Stockton. The name that seems specially to mark the decade is that of Theodore Winthrop, whose sad death in battle cut off a novelist, not perhaps of great performance, as some friendly critics have maintained, but at least of racy originality and of much promise.

The thirty years that have elapsed since 1870 seem to form a distinct period that gives few or no signs of coming to a speedy close. Leaving out the great survivors of the ante-bellum period, it can boast of scarcely a single master-name, that of Sidney Lanier being perhaps most marked in poetry, and those of Mr. Howells and Mr. Harte and Mr. Clemens in fiction. Yet it has been an epoch of growing literary activity, and the average quality of the work done has steadily risen. In other

words, democracy seems to have triumphed as completely in the realm of letters as in that of politics. In classical scholarship and criticism, in history and economic and social science great advances have been made. In fiction a notable school of realists has been developed. Every section and nearly every State has furnished a local novelist of power,—the South and West having shown the greatest relative activity,—the international novel has been cultivated, and the short story brought to a remarkable degree of perfection. There has also been a revival of interest in historical romance, and the demand for native fiction has in many cases assumed startling proportions. Magazines of every quality have flourished exceedingly, and the better newspapers have devoted more attention to literature. Literary clubs and popular lectures have done much to foster the taste for reading, and a cohort of pushing publishers stands ready to exploit every writer of talent. New York has become once more the centre of the nation's literary activity; but Boston, Chicago, and Philadelphia are worthy rivals, and there are signs that several provincial centres may be developed. It is obvious, however, that those who are of a period cannot well understand or describe it. It seems, then, scarcely necessary to incur the reproach of invidiousness by singling out distinguished contemporaries for special comment. Yet Professor Lounsbury, Dr. Eggleston, Secretary Hay, Mr. Henry Adams, Mr. Gilder, Mr. James, Mr. Cable, and Mr. Harris have been so long before the world that they may be cited to illustrate the range and quality of our comparatively recent work; while it is surely permissible to close this sketch with a few fine names already consecrated by death,—such names as those of Helen Hunt Jackson, Emma Lazarus, H. H. Boyesen, Constance Fenimore Woolson, Phillips Brooks, H. C. Bunner, Richard Malcolm Johnston, Eugene Field, Stephen Crane, and that genial and

sympathetic friend of all that is best in humanity, Charles Dudley Warner, to whom so many younger writers owe deep personal gratitude. With the works of these and of many other excellent authors that must be nameless here, and with the high average value and great variety of literary production of our modern period, its future historian, while doubtless casting wistful glances at the more splendid annals of the mid-century, will have no unpleasant task before him.

ENGLISH LITERATURE IN THE NINETEENTH CENTURY

By Edmund Gosse

THERE are certain landmarks in the history of modern English literature, which, without being of paramount importance in themselves, serve to remind us vividly of the imminence of change. Among these are the accession of James I. in 1603, the death of Dryden in 1700, the publication of *Lyrical Ballads* in 1798. We are unable yet to withdraw into sufficient perspective to perceive what event of the passing decade will hold for the twentieth century a like importance. But we are beginning to be able to follow the course of the nineteenth century, and we can already, perhaps, get far enough away from its literature to compare it with that of its predecessors. To the literary historian, the period of English letters which offers the most ideal conditions is the eighteenth century; not too irregular, yet full of variety; not too crowded, yet singularly well supplied with striking and picturesque figures. If the history of English literature as a convenient and shapely object of study was advancing until 1798, it certainly since then has declined, tending to become, that is to say, confused, choked, and bewildering. But we can hardly doubt that the twentieth century is destined to be still more overcrowded, still more pathless; and as time proceeds, in the horrible onset of unnumbered books, it is probable that literary history will cease to be attempted, and the deafened world will simply turn back to a contemplation

of the old quiet times. By the side of the literature of the twenty-fifth century that of the nineteenth will probably seem cool, sane, and Quakerish.

At present, however, we are more conscious of the exceptions than of the general plan, yet perhaps something of the latter may already be perceived. To venture on one of those broad generalisations which are merely useful as leaping-poles to carry us bounding over chasms in the path, I would define the nineteenth century in English literature as a period of individualism. It followed a century which had been mainly interested in general ideas. David Hartley had given us his *Observations on Man* and Hume a *Treatise on Human Nature*. These were exactly to the taste of 1750, but in 1850 we wanted to receive observations on the man, Carlyle, and what was welcome was a treatise on the personal nature of Ruskin. It is a commonplace to say that the eighteenth century closed in revolution, and that the nineteenth is the result of that cataclysm. But, in studying all cases of successful revolt, the great interest is to discover whether the old dynasty comes back in a new form or whether a new dynasty is inaugurated. After the romantic revolution of 1798 did the old rhetoric come back again, or did a new thing take its place?

We are in the habit of thinking that the spirit of the eighteenth century was killed by Wordsworth and Coleridge. But we neglect to observe that it was on the point of being brought to life again by Byron and Shelley. Those poets were saved, and our romantic literature was saved with them, by the happy accident that each of them was born with a temperament so extremely individualised that it overweighted his tendency to rhetoric. But if Shelley—with his force and genius, and his native passion for oratorical effect—had possessed no inclination to analyse his own feelings, he might almost have succeeded in stemming the tide of romanticism.

And this moment of danger under the reaction against Scott and Wordsworth was but the first, although perhaps the most important, of successive resistances which recurred up to the end of the century.

The general course, then, of the last hundred years in English literature has been one of individualism as a strong current, every now and then unsuccessfully fretted by attempts at reaction. The form that this individualism has taken has been mainly that of self-study and self-revelation. The seventeenth century was all phenomenal and dramatic, with stormy fits of external observation. The eighteenth century sought, in unruffled calm, to meditate on Man and the broad generic principles of his action. The nineteenth century shattered this artificial " dome of many-coloured glass " into innumerable fragments, each fragment an epitome of human kind; and desired to know the wants, the passions, and even the frailties of each individual. If we glance at the most characteristic names of the nineteenth century,—Coleridge, Byron, Keats, Carlyle, Thackeray, Tennyson, Rossetti, Ruskin, Stevenson,—whom we will,—they are all the names of men who have written, with more or less tactful show of reticence, mainly about themselves, who have judged mankind by samples of brains and blood, who have made self-study and self-revelation the starting-points of all their adventures in the edification and entertainment of mankind. And in this sense Robert Browning, it may be, sums up the century and is its most characteristic exponent, since he, more consistently than anyone else, has repeated the thoughts and emotions of us all, only with those splendid modifications which are the ornament of genius. And then, at last, comes Mr. Rudyard Kipling, who breaks with all his ancestors, who appears to have no desires or feelings of his own, who is exclusively external and objective, for whom (just as for the eighteenth century) " a

man " is nothing and " Man " is everything. Is he the precursor of a totally new condition of literature, in which psychology, the analysis of the soul, will be rejected, as the impersonal rhetoric was rejected a hundred years ago? Perhaps so, but this is not the place for prophecy.

In consequence, perhaps, of its tendency to self-study, the nineteenth century has been pre-eminent in the production of lyrical poetry. The young man, vividly conscious of the peculiarities of his personal temperament, and seeking solace in self-description, naturally confides his sorrows and his longings to the world in song. Looking back over our history, we find the century which has just closed to have been above all others the age in which the lyrical voice has made itself heard. This predominance of poetry is to be judged, not by the number of persons who have appreciated it,— for those have often been few,— but by the force, skill, and variety of the poets themselves. That is to say, time soon eliminates the commercial element of success, and one fit reader overweighs a million of the unfit. Mr. Percy B. Shelley and Miss Jane Porter, for instance, attempted to address the English public at the same moment. It is no exaggeration to say that the lady possessed ten thousand admirers for every one that listened to the gentleman. The instance is not an unfair one, because the authoress of *Thaddeus of Warsaw* was not one of the worst, but one of the best deciduous novelists of her time. Yet her romantic prose is forgotten, and Shelley's verse is as indestructible as diamonds.

When we admit that it is the poetry of the century which has been its most characteristic feature, we go on to conjecture that its regular and stately growth from one single stem has a great deal to do with this uniform distinction. In the seventeenth century, when also poetry flourished with so much splendour, its growth was

capricious and irregular. It rose to violent heights in Shakespeare and his compeers, it sank to positive inanity in the later dramatists; it spread upward once more on a totally different plane at the Restoration, it expired with the expiring century. But a magnificent uniformity of development has distinguished the English poetry of the nineteenth. There has been a regular transmission of the great lyric manner. There has been no extraordinary disinclination to tread in the steps of the ancestors. Wordsworth and Coleridge are followed by Byron and Shelley, Keats and Tennyson by Browning and Rossetti; the web is complicated by the gorgeous threads of colour shot through it, but it remains one texture. Nor, certainly at the death of Tennyson, in 1892, could it be perceived that any new tendency or stream of influence had entered English poetical literature since the publication of the *Lyrical Ballads* of 1798.

In the novel, which is the other great popular division of literature as it is generally understood, although there has been remarkable and even preposterous abundance of production, the result does not seem to be in any way so characteristic. If the figure of Johnson present itself to us as representative of the centre of the eighteenth century, it is not any novelist, it is rather a prophet, Carlyle, or a poet, Tennyson, who occurs to us as the typical literary personage of the centre of the nineteenth. This may be partly because the impressive uniformity of ideal which we have noted as a striking source of strength in the line of the poets is totally wanting in the line of the novelists. At the very opening of the age there was discord between the romance of Walter Scott and the naturalism of Jane Austen. But this might have been gradually eliminated if a genius had not arisen in whose hands the confusion became ten times greater. Dickens, one of the most enjoyable of writers, is one of the worst disturbers of literary history. He arrived at a

time —1835 — when the extinction of other forces in fiction made insistent the call for a thoroughly sober novelist of manners. Dickens arose with his gigantic humour, his fantastic misrepresentation of human nature, his incomparable vitality and vivacity, and he made the novel as a branch of sound literature in England almost impossible. Dickens led the whole nation away from the idea of the novel as a faithful picture of life, and he did this just at the moment when Balzac was leading the French habit of mind back to reality and genuine observation. When Dickens was at the height of his influence, that influence was resisted by Thackeray and by the Brontës. We owe much to the strenuous labours which made George Meredith, and, later, Thomas Hardy and Robert Louis Stevenson, possible. But it will take us English long to escape from our critical disrespect for experience, and even in *Tess of the d'Urbervilles* and in *Dr. Jekyll and Mr. Hyde* the Dickens deformation of types and incidents is marked. Of this national disease, this indifference to reality, the main bulk of nineteenth-century English fiction has died already or must soon be dead.

In an age of marked individualism the study of history is sure to show freshness and a novel zest. We are so much interested in ourselves that we recognise the futility of treating our ancestors as abstractions. Even if we falsify our fiction, we must pursue truth—minute, particular, unembroidered truth — when we are discussing fact. We are no longer satisfied with the trappings of monarchy, with the crown and the robes of state, but we endeavour at every point to resuscitate the human movement of the crowd. Hence the nineteenth century has been an age in which history has so greatly flourished that, as we look back, this seems one of its main intellectual distinctions. Quite at the beginning of the hundred years there were those modest rebels against rhetoric, Sharon Turner, Sir Francis Palgrave, Lingard Napier.

These were, after their fashion, disciples of Gibbon, and they passed on the lamp of research to Hallam. These men started the theory that you should build "the history of a country upon unquestionable muniments," and this the nineteenth century has proceeded to do. There followed an interlude of brilliant writing, in which Macaulay and Carlyle raised this branch of literature to the highest popular honours. But the historians who really carried on the tradition went back to the precursors for their art; in Froude's hands we see, not Macaulay at all, nor even Hallam, but a vivification of the patient methods of Palgrave. In Froude first we see the completed individualist historian, who illustrates personal character without losing hold of the political situation, working towards a definite aim, with perfect composure. His great rival, Freeman, keeps more closely still—almost too closely—to the authorities. Too closely, one thinks, because the imperfect psychology of the mawkish chronicler may make him a worse guide to the sources of action than the common sense of a wise man living many hundreds of years later. But the clear line of truth sweeps round, in the hands of conscientious and scrupulous historians, Stubbs, Gardiner, Hodgkin; and the nineteenth century closes with an immense labour of systematic research performed, and adorned, more than we sometimes are willing to acknowledge, by the durable splendour of style.

In philosophy, the nineteenth century has not been illustrated by a succession of critics of abstract thought, as the eighteenth century was. There has been no Berkeley, or Hartley, or Hume, or Reid,—no chain of lucid thinkers descending from theory to theory. But two men of gigantic intellect have given enormous impetus to thought by concentrating their energies on a theory which shall combine the principles of biology, psychology, and sociology. This is, of course, the famous

theory of evolution, applied by Darwin and Herbert Spencer to all systems of nature, organic and inorganic. In the briefest sketch of what the nineteenth century has done in literature, it is absolutely imperative to mention the publication of *The Origin of Species* (1859) and *Principles of Psychology* (1855), because, although neither work is written with an attractive elegance, each is the starting-point of an intellectual and moral revolution so vast that every branch of life is affected by it, and literature itself — in its lightest forms — can no longer ignore the germinal forces with which evolution has quickened all our emotions.

Ruskin would fain have been numbered, also, with the philosophers. But the philosopher must be consistent and he must be calm. It was not Ruskin's privilege to see life serenely or to see it whole. He saw it, however, with penetrating passion, and his deepest claim upon us is not for what he divined, but for what he reported. If we must place him, it will be with the prophets or critics, not with the philosophers. He is the finest descriptive writer in the English language, and that section of the literary activity of the nineteenth century which depends on the instant and almost magical rendering into brilliant language of a violent impression culminates in Ruskin. He is the greatest, though far from the soundest or broadest, of the English critics of the century, and he is intensely characteristic of it, because of his unbridled, often tiresomely excessive, always poignantly acute, individualism. He is master of the criticism which aims not primarily at making us know, but at making us feel; and in consequence Ruskin, who is very often wrong, and sometimes even indifferent to his error, has radiated knowledge and sensation into the remotest corners of the age. He then, too, for his worship of beauty, his magnificence of style, his ardent and reckless pursuit of intellectual and moral vitality, must always be

mentioned as one of the leading " types " of the nineteenth century.

It would not be fair to dwell on the brilliant successes of individualism in the nineteenth century without confessing to its failures also. That " charlatanry " which Taine recognised as the main danger of modern thought, the rapid dismissal of sides of a question which require sustained consideration—ignorance, in short, married to presumption — has not been absent from the production of the nineteenth century, and has often disfigured it. But it was not absent from that of the seventeenth century; perhaps wherever there is rapid movement and vivid vitality, this turbid element is roused and cannot be evaded. If we look at the records of satire, we shall find that each successive generation has seemed to its own cynics to be more deeply afflicted with it than any other. But a very happy circumstance is that this floating and whirling rubbish invariably sinks to the bottom, and the historian is not called upon to share the agitation of the satirist. The bad novels and bad poems and bad essays of 1810 and 1840 and 1870 were very trying indeed to people who lived beside them and watched their popularity. But when we look back at those years we think only of what was of durable merit. So—let us have the courage not to question—will it be with the tares and wheat of 1900.

Some weeds, however, have very pretty flowers, and while they last they attract and disturb attention. This is a phenomenon which seems to be characteristic of the nineteenth century, and which is worth noting. In the eighteenth, where there was a more exact standard of literary merit, whatever attained a certain definite acceptance might expect to retain it. To this day we return to the faded minor masters of the age of Queen Anne or George II., feeling that, up to their modest level, they hold their own; people like Parnell or

Akenside have sunken, but they will sink no more. There they are, embedded in history, stationary for what they may be worth. But since the Romantic Revival there has been a tendency for literature to be invaded by names which proved really ephemeral, representing writers who did not write badly, but who could not make themselves ultimately felt; these people have not become small and dry, but have disappeared altogether. At various periods since 1800, authors have attained considerable fame and wide circulation who have now ceased to exist. No pre-nineteenth century obscurity compares, for instance, with the absolute extinction of James (not Robert, who was simply a bad writer) Montgomery, of Samuel Parr, of T. N. Talfourd, of Douglas Jerrold—names taken at random.

This is quite what one would expect of a literature patently individualistic, since, when it is mainly the expression of personality which interests, if the person is void of real importance, when once that emptiness is detached, nothing attractive remains. Hence, even when there was a genuine individuality, the presence of artificiality and non-reality greatly endangers its permanence. We tremble for some of the most famous names of the middle of the century. We ask ourselves whether the faint and rigid sincerity of comparatively small writers like Gray or Cowper may not preserve them long after Bulwer Lytton and Elizabeth Browning have ceased to please. One thing is quite certain, and it must be faced with intrepidity: history will not endure the burden of the immense literature which the nineteenth century has laid upon its shoulders. It will bear much, for instance, but it will not bear the torrents of verse from Wordsworth to Mr. Stephen Phillips without encouraging tremendous leakage, evaporation, and diversion. Nevertheless, it is probable that the poetry will stand the test more satisfactorily than the prose. The nineteenth century has been most distinguised, most constantly

successful, in its verse; the finest gift which it presents to posterity is unquestionably its unrivalled succession of poets,—names of which not only any century but any country might be proud.

It is perhaps interesting to endeavour to see what are the greatest names of influence which have diversified the face of this crowded, turbulent, motley century of literature. To the critics of the first quarter of it, prophesying in a vacuum, certain names appeared the most prominent which we should now not mention in a very rapid survey. But of the earliest generation Wordsworth and Coleridge remain, the Dioscuri of our romantic poetry, every year shining more brightly as they slide higher up the firmament. In the next generation we still meet Byron, sadly despoiled of his beams, in spite of the overemphatic eulogy of a few untimely admirers, but always acutely alive as an individual; Shelley, who perhaps has passed the meridian of his influence; and Keats, still advancing steadily, and likely, perhaps, in remote posterity, to prove the most durably delightful of all the poets of the century. Later, Tennyson, Browning, Matthew Arnold, Rossetti, Swinburne, are the most illustrious poet-figures, each attended and succeeded by presences scarcely less splendid than his own.

In prose, the names are myriad. As we glance very superficially down the whole century, and endeavour to perceive it comprehensively, the most eminent of those who have made literary expression in elaborate prose their object, and have endeavoured to produce in it effects analogous to those of verse, are De Quincey, with his mellifluous splendour; Charles Lamb, with his tender resuscitation of the seventeenth-century forms; Macaulay, the unimaginative, so positive and pleasing; Carlyle, with his turbulence and thunder; Thackeray, and Froude, and Matthew Arnold, in their various modes so harmonious and persuasive; Newman, with his lucid amenity;

Ruskin, unapproached in the splendour of " his flights and his music," like the Bee in Swift's *Battle of the Books*. To these nine, if a tenth name were to be added, in the judgment of not a few of those of the younger generation it should be that of Pater—an opinion which I record without venturing to affirm or reject it.

The current reviewers of books love to gird at the pretensions of " style," and repeat to weary ears the commonplace that it is what a writer says that is of importance, and not how he says it. It is not worth while to combat this contention, which springs up in the daily and weekly press like a pretty daisy. But when we attempt such a heroic, such a ridiculous task as to recapitulate in a brief essay the crowning merits of a whole century, we see how completely everything unattended by a fine manner disappears. In the larger sense, in the wider outlook, positively nothing whatever remains observable in imaginative literature except what has been recorded with consummate technical skill. In the survey of one hundred years, where so much has been written by an infinite cloud of authors, we have no time nor space to consider whether such an one displayed a valuable chain of moral thoughts or desired to deliver himself of really sound ideas. We are driven to selection, and we select those whose expression, whose form of delivery, was the most original and splendid. Keats had nothing very important to say, and while he was singing it infinitely graver matters were being discussed by Godwin and by Mackintosh, by James Mill and by Jeremy Bentham. But it is now Keats, and not these people at all, who is read, and read with rapture. Perhaps the most striking lesson which the study of English literature in the nineteenth century has to offer us is that the only absolute element of literary durability is style.

THE AMERICAN THEATRE IN THE NINETEENTH CENTURY

By J. Ranken Towse

THE net results of the nineteenth century in the theatre in America may be summed up comprehensively as a general decadence in the art of acting,—using the term in its strictest sense,—a great development of the mechanical and decorative devices of stage representation, and the practical extermination, temporarily at least, of the higher forms of the drama by the substitution of wholly commercial for partly intellectual methods of management. The masterpieces of tragedy and comedy are no longer performed except for their spectacular possibilities; not because the public will not pay to see them — the falsity of that charge has been demonstrated over and over again within the memories of all but the very youngest — but because there are no players capable of interpreting them acceptably, in consequence of the extinction of the old stock companies, the schools in which the histrionic apprentices of preceding generations were instructed in all the mysteries of their craft. Acting, as formerly understood, meant the acquisition of Protean gifts: the concealment of the personal beneath the assumed individuality; the expression of emotions, traits, and habits foreign to the actor and appropriate to the fictitious character or circumstance; the mastery of eloquent and dignified gesture and the cultivation of the vocal resources in order to insure a facile, significant, melodious, and illuminative delivery of the text. There

were certain acknowledged standards to be followed, with living authorities to preserve, illustrate, and enforce them; and thus were established broad laws or traditions, subject, of course, to the modifications of individual genius, which created distinct styles in the various branches of acting, whether tragic or comic, in which all actors were expected to perfect themselves, and which were exacted as a test of proficiency. Beyond doubt, the system, to some extent, fostered a certain formality and artificiality, but it necessitated study and practice, was productive of a wide versatility, and required a variety of accomplishments which entitled the theatrical calling to be accounted a profession. Our modern actors have no such educational advantages, and rather affect to despise them. They seem to proceed upon the assumption that the one purpose of the theatre is not the embodiment of the author's conception, but the exploitation of their own private characteristics. Their object is no longer interpretation, but adaptation; the adaptation, that is, of the author's ideal to their own personalities; and so incapable are they, as a rule, of any originality or invention, that the chief employment of most of our dramatists is a sort of dramatic tailoring — the cutting and trimming of theatrical suits to display to the best advantage the meagre proportions of our stage exquisites, who vainly imagine that their individual peculiarities of voice and manner constitute a formula for the expression of every mood or passion known to human nature.

The history of the American stage, from its inception, is connected so intimately and indissolubly with that of the English that to consider it separately would be to ignore the greater part of it. Although American dramatists were plentiful and industrious in the early part of the century, they by no means confined themselves to American subjects, while such national plays as they produced were often of a farcical nature, or, if serious,

deficient in those literary and dramatic qualities essential to long vitality. The standard English drama was still in the ascendant, and was interpreted by the greatest English actors of the day, or by players who had studied acting in their company. From 1800 to 1825 was a splendid period upon the English stage. It was the era of the Kembles, of George Frederick Cooke, of Thomas Abthorpe Cooper, of Eliza O'Neill, of Edmund Kean, of Dora Jordan, Munden, Elliston, the elder Mathews, Liston, Frances Abington, and others scarcely less illustrious. Of these, Cooke, Cooper, and Kean were as well known on one side of the Atlantic as on the other, and it is noteworthy that they could find companies, of mixed English and American nationalities, fully able to support them in all the plays of their extended repertories, at all the then existent American theatrical centres: New York, Boston, Philadelphia, New Orleans, Savannah, Baltimore, St. Louis, and Cincinnati.

The limits of this sketch will not permit anything like a detailed account of particular players and performances, and a mere enumeration of names and dates would be tedious and uninstructive. It is only possible to make brief note of salient points, and of these many may be found in the career of Thomas Abthorpe Cooper, which was thoroughly typical of the time. This splendid performer, one of the most versatile, graceful, powerful, and fascinating actors that ever lived, was identified with the American stage from 1800 to 1835, and won triumphs in every department of the drama. A very imperfect list of the characters in which he excelled will convey some notion of the quality of the entertainment then provided for the public, and of the labour entailed upon the actor, when the means of transportation were limited and difficult and changes of programme incessant. Among his most frequent impersonations were Macbeth, Othello, Hamlet, Leon (in *Rule a Wife*), Damon, Beverly, Virginius, Pierre,

Duke Aranza, Richard III., Petruchio, Rolla, Mark Antony, Alexander the Great, Romeo, Hotspur, Iago, Penruddock, Coriolanus, and Octavian (in *The Mountaineers*). Others were Albert (in *Werter*), Antonio (*Merchant of Venice*), Bajazet, Benedick, Brutus, Wolsey, Captain Manly (in *The Plaindealer*), Cassius, Charles de Moor (in *The Robbers*), Charles Surface, Don Felix, Don Juan, Doricourt, Edwy (*Edwy and Elgiva*), Falconbridge, the Ghost (*Hamlet*), Harry Dornton, Jacques, Henry V., King John, King Lear, Lord Townly (*Provoked Husband*), Luke (*Riches*), Master Walter, Mr. Oakley (*Jealous Wife*), Mercutio, Prince of Wales (*Henry V.*), Sir Edward Mortimer (*Iron Chest*), Sir Peter Teazle, Falstaff, Shylock, Young Wilding (*The Liar*), and Zanga. In all, he played 176 leading characters, and it is further recorded of him that he visited every State in the Union, played in sixty-four theatres, and travelled twenty thousand miles, mostly in his own carriage, no railroads then being in operation.

The significance of these facts as an indication of the public taste is evident. It is important to remember that the theatres of those days were comparatively small and the prices of admission moderate, so that a succession of full houses was absolutely essential to financial success. Yet managers and actors alike prospered. Such performers as Cooper rapidly acquired comfortable fortunes, even if they did not always keep them. Wherein lay the secret of success? Certainly not in the tricks of advertisement, in the notoriety of particular "stars," in the smothering of wholesome competition by a vast monopoly, or in the meretricious attractions of glittering accessories. Elaborate stage-settings were first introduced into this country by Eliza Vestris between 1825 and 1850. Nor was Mr. Cooper without illustrious rivals. Among his contemporaries were George Frederick Cooke,— who excelled him in certain characters, and sometimes played opposite parts to him,— Charles Kemble, Joseph George

Holman, Edmund Kean, Mrs. Barrett, Mrs. Merry, and many others of almost equal distinction, while in his supporting casts may be found the names of such players as Forrest, Hackett, Holland, J. W. Wallack, and others who themselves were to be famous in the succeeding generation, though in a lesser degree. The excellence of the old stock companies is attested by a host of competent observers. In all the principal cities there were bodies of thoroughly disciplined and versatile players, ready at a moment's notice to appear in either tragedy or comedy, or to play both on the same evening, with equal facility and intelligence. The theatre, in a word, flourished because it was conducted mainly upon artistic and sound business principles. If the scenery was often old, inadequate, or nondescript, the costumes arbitrary, queer, and anachronistic, the lighting bad, and the furniture a weird assortment of odds and ends, the interpretation of the play itself was vital; the impersonations bold, distinct, and actual; the action rapid and spirited, and the delivery of the text marked with an appreciative emphasis and an elocutionary grace and force which vanished from the English stage with the death of Phelps, and from the American with the retirement of Edwin Booth a few years later.

The older English drama, presented on the lines prescribed by direct and uninterrupted tradition, was the staple entertainment of that golden age, but the fare was infinitely varied. Prodigious was the theatrical appetite of the public, and the custom was to flank solid dishes on the programme with lighter dainties. Tragedy, comedy, and farce were often to be found on the same bill, and contributions from contemporary authors were plentiful. There was no lack of American playwrights. A recent publication of the Dunlap Society gives a list of one hundred and fifty American authors of plays performed between 1714 and 1830, and of these the vast majority

were produced after 1780. They ranged in style from poetic tragedy to uproarious farce and extravaganza. Among them were versions of popular novels, domestic and foreign; adaptations from the French, German, and Italian theatre; patriotic military pieces based upon Revolutionary incidents, pioneer Indian dramas, local skits of town and country, and a number of pieces relating to the French Terror. Nearly all of them were forgotten long ago except by the student of the stage, but not a few held the footlights for many years. The name of William Dunlap, who has been called the father of the American theatre, is conspicuous in all the annals of that time. He was a man of varied accomplishments who earned for himself a niche in the temple of fame as an admirable writer on art and as the founder of the National Academy of Design. As a manager he failed, and as an actor he won no laurels, but he was a most prolific and successful playwright. The quality and scope of his work may be indicated by a few of his titles: *The Father; or American Shandyism*, *André*, *False Shame; or The American Orphan in Germany*, *The Wild Goose Chase*, *Pizarro in Peru; or The Death of Rolla*, *The Voice of Nature* (an adaptation from the French, *Le Jugement de Salomon*), *Rinaldo Rinaldini*, *Peter the Great*, and *The Battle of New Orleans*. Other popular plays by American authors were the *Edwy and Elgiva* of Charles Jared Ingersoll, in which Mrs. Merry was famous, *Marion; or The Hero of Lake George*, and *The Grecian Captive; or The Fall of Athens*, of Mordecai M. Noah. *Pocahontas*, the production of George Washington Parke Custis, son of Mrs. Washington, was presented successfully in several cities, as was the *Lafayette* of Samuel Woodworth. It was in 1820 that the *Brutus* of John Howard Payne, a notable tragedy only lately fallen into disuse, was first acted in this country, repeating the triumph which it had won in London, where the author, who had his inspiration from Talma,

enjoyed high repute as an actor. Payne wrote about sixty plays in all, but few of them are now remembered. Even his opera *Clari* suggests but little to the average reader, although " Home, Sweet Home," which was first sung in it, is probably immortal. *Thérèse, the Orphan of Geneva*, and *Charles II.* were favourites in their day. Later on, in 1829, came the *Metamora* of John Augustus Stone, but the success of that was one of the symptoms of an oncoming degeneracy. These examples are sufficient to show the considerable part which American dramatists played in this era, and the dignity of their more pretentious efforts, but the influence of the foreign stage, especially the British, was even then predominant. A curious instance of this is the fact that in 1816 when the *Marmion* of James Nelson Barker, a Philadelphian, was presented in New York, it was announced as the work of an Englishman, avowedly for the sake of avoiding the recognised prejudice against native products.

After 1825, the American theatre, as a school of acting, began to show signs of feebleness and decay, which manifested themselves first in high tragedy and poetic drama. The fiery genius of Edmund Kean waned, flickered, and expired. For two brief seasons, in 1832–34, Fanny Kemble, as Juliet, blazed as a splendid meteor in the theatrical firmament, and then abandoned the stage for the platform, leaving Junius Brutus Booth the one great tragic actor before the footlights. As his star grew dim, that of Charlotte Cushman rose, but her impersonations, male and female, remarkable as they were for power, insight, and masterly execution, were not touched, except in one or two instances, by the glory of inspiration. But she was an artist whose forces were subject to the restraints of intellect. This was not the case with Edwin Forrest, her most conspicuous contemporary upon the tragic stage, whose potent influence, exerted, unfortunately, in a period of transition when there was no better

example to counteract it, was exceedingly mischievous. He was a man of rough but untutored genius, cursed by an imperious nature that brooked no interference and ignored its own infirmities. Endowed with a splendid person, unlimited endurance, and a voice of tremendous volume, he dazed and captivated the crowd with the magnificence of his virility and the whirlwind of his passion. His acting, marvellously effective in certain characters, as distinct as Othello and Metamora, was the apotheosis of physical prowess, the ultimate development of rant. The criticism of the judicious, which was plentiful, was drowned in the uproar of vulgar applause, and the homage of the mob confirmed him in his worst offences against the principles of true art. Having the field practically to himself, by sheer force of personality he established the new and pernicious standard of robustiousness, and of course had imitators, of much inferior mental and physical calibre, who descended to lower depths and gradually brought the higher drama into disrepute.

Such importations as came from the English stage were powerless to create a reaction. Charles Kean, a pedantic enthusiast but second-rate actor, eked out indifferent performances with superb and scholarly stage representations, imitating the reforms initiated by Macready, but leaving no permanent impression, while Macready himself, fine actor and great reformer as he was, lacked the magnetism which appeals to the great mass of playgoers, and, moreover, was handicapped by the bitter animosities which culminated in the lamentable Astor Place riot. The final retreat of the latter to England left Forrest and his school in the ascendant, and the higher tragedy continued to languish until it perished with Edwin Booth. The brilliancy of the latter's personal achievements, especially in the characters of Hamlet, Shylock, and Iago, in which he was supreme, kept life in the Shakespearian

drama until 1890, but, except in the early days of his career, he cared nothing for the quality of his support. Acquiescing in the abominable star system, which had been slowly but surely strangling the stock companies, he was content to shine alone amid a body of abject incompetents, and, training nobody, passed away without a successor. It might have been different if he had had rivals to prick the spur of his intent, but E. L. Davenport, a great actor and artist, belonged to a rather earlier period, while Lawrence Barrett, though inspired by a noble ambition, did not possess the precious gift of genius.

The decay of high comedy was much more gradual, for the simple reason that the old traditions were preserved in a succession of such stock companies as those at the old Chambers Street Theatre,—which flourished from 1848 to 1856,—the first and second Wallack's, and Daly's in New York; the Boston Museum, and the Chestnut Street Theatre in Philadelphia. They were genuine schools of acting, in which were reared a host of gifted players who perpetuated and disseminated the traditions of the old classic style, with all its easy and authoritative grace of manner, its bold and spirited yet neatly finished execution, its strong characterisation, and its mastery of vocal tone and emphasis. A veritable feast of humour was provided by William E. Burton, who was equally happy in the broad extravagances of Toodles, the unction of Falstaff, the liquorish revelry of Sir Toby Belch, the stolid fantasies of Bottom, or the grotesque savagery of Caliban. William Rufus Blake was scarcely less illustrious, while the names of William Warren, John Gilbert, John Brougham, the Wallacks, Mary Gannon, Mrs. John Drew, George Holland, Charles Fisher, Chippendale, W. J. Florence, Joseph Jefferson, and others of not much smaller note are still fresh in the memory of veteran playgoers. Mr. Jefferson, happily, still lives, the one shining exemplar of the finished comedian of the mid-century,—

of the real master of his art. With his death the race will become extinct, because there is no longer any school in which the art of high comedy is practised. So far as the purely American stage is concerned, poetic tragedy and old comedy are dead, or at least comatose.

Will there be any revival? That is a difficult question to answer. It is just possible that a quickening impulse may come from England, where the lack of good modern plays is compelling managers to revert to the standard drama. The splendid example set by Henry Irving is bearing fruit, and the names of old masterpieces are beginning to reappear upon the programmes. A group of ambitious young actors is forming, and there is a bare chance that a new era of theatrical brilliancy may be at hand. In that case, it would not be long before the American stage enjoyed at least a reflection of its glory. The establishment of anything like a native theatre seems to be more remote than ever. There does not exist, at the present moment, a single American dramatist, with the possible exception of Mr. Bronson Howard, of acknowledged repute. Of such writers as Augustus Thomas, James A. Herne, Clyde Fitch, or William Young, it can only be said that there is in their work some promise of valuable future achievement. There is not, indeed, much hope just now for native talent. The speculators who, during the last few years, have acquired control of all our theatres, are disposed to frown upon it. It is seldom, indeed, that they will incur any monetary risk in encouraging it, except in the adaptation of lewd French farces —which have replaced the French emotional drama of twenty years back — and popular novels of the moment. Having exterminated the schools of native actors, and crushed the aspirations of native authors by their blind and selfish policy, first in the star system and more recently in the syndicate scheme which has grown out of it, with all the attendant evils of long runs and an in-

equitable division of profits, they now have no other resource than to import both plays and players. In the war plays, in Western melodrama, and in occasional pieces such as *Barbara Frietchie* or *Peter Stuyvesant* there is distinctive American nationality, but more and more the leading theatres are abandoned to the alien actor and the alien playwright. In all other branches of art — in painting, sculpture, and architecture, in music and literature — American genius has challenged admiration by its originality and vigour, by its rapid and constant progress. Only in the American theatre is the foreigner supreme. To him we look for our choicest entertainments,— a year or two after they have been approved in London or Paris, —our wittiest or most moving plays, our most fascinating and capable performers. Only in the luxury, not always in the good taste, of our stage appointments do we equal or excel all rivals. Without tragedians, without comedians, without playwrights, the American theatre, as a separate entity, is a pitiful illustration of the ill effects of the destruction of competition by a greedy monopoly.

THE MUSICAL CENTURY

By H. T. Finck

MUSIC is the only one of the fine arts of which it can be said that it reached its highest development in the nineteenth century. It is the modern art *par excellence*, and while everybody has been told that it is the youngest of the arts, few realise how much is implied in that assertion. More than two thousand years ago poetry, architecture, and sculpture had reached heights in Greece which have never been surpassed. The greatest poet of the nineteenth century would have been only too proud to have written the *Iliad* and the *Odyssey* exactly as they were recited twenty-seven hundred years ago; nor has the nineteenth century produced architects, sculptors, and painters superior to those of ancient Greece and mediæval Italy. But no nineteenth-century composer would have dreamed of writing music like that which the contemporaries of Phidias or of Titian listened to. The Italian operas of the seventeenth and eighteenth centuries are never sung now, and our concert programmes very seldom contain a composition older than Palestrina, who died in 1594. Music, as relished by us, is therefore only three centuries old, or twenty-four centuries younger than the poetry we enjoy.

Nor is this all. Even the compositions of the seventeenth and eighteenth centuries are fast becoming an "acquired taste," enjoyable only by musical scholars and antiquarians. Music, in truth, is an art still in the process of evolution, and it is therefore not surprising to

find that of all its branches only one—the ecclesiastic—reached its highest pinnacle before the nineteenth century, which, therefore, must be called *the* musical century. The oratorios, cantatas, and other choral works of Bach and Handel, written in the first half of the eighteenth century, have never been equalled, although excellent choral compositions, both ecclesiastic and secular, were written by Beethoven, Schubert, Mendelssohn, Schumann, Berlioz, Saint-Saëns, Rubinstein, and many others. But in the departments of chamber music, orchestral composition, pianoforte pieces, lyric song, and opera, the last century marks a decided—in most cases an astounding—advance over the eighteenth. To prove this assertion is the object of this review.

In the modern sense of the word, chamber music means duos, trios, quartets, etc., for pianoforte, and one, two, three, or more different orchestral instruments; or for a corresponding number of orchestral instruments without pianoforte, the favourites being duos (usually sonatas) for piano and violin or violoncello, and quartets for two violins, viola, and violoncello. In this branch of the art the superiority of the nineteenth century lies less in the matter of form and style than in the abundance of good things. It is true that the style of the Hadyn trio is far from satisfactory, because the violin and the violoncello do little more than double up the melody and the bass, respectively, of the piano part. But in the best of his quartets we find more individualisation of the several instrumental parts, and Mozart still further carried out this tendency of giving each player's part an equal interest and importance. The architecture, or cyclical structure, of chamber music has also undergone little change since their time. But whereas Haydn and Mozart are practically the only chamber-music composers of their age still heard in our concert-halls, the new century provided a number of masters, of whom at least three—

Schubert (the greatest of all in fertility of ideas, sensuous beauty of colouring, and emotionalism), Beethoven, and Schumann—surpassed them in this field; while several others (notably Mendelssohn, Rubinstein, Tchaikovsky, Brahms, and Dvôrák) ran them a close race.

It is said that Richard Wagner, who in his earlier years was an almost fanatical admirer of the symphonies of Beethoven, tired of them in the last years of his life and took refuge in Bach, the master of masters. Others have had the same experience in regard to these compositions, from sheer surfeit of hearing them; and this may put some in the mood for underrating them. But to realise the stupendous advance these symphonies indicate, we must compare them with Haydn's and Mozart's. Haydn's seem like toy houses, while even of Mozart's only three or four have preserved their vitality, and we smile when we hear the last of his works in this branch —as cheerful and sunny a piece as has ever been written —and reflect that our ancestors called it the "Jupiter" because of its supposed power and grandeur.

With the exception of the first (which might have been written by Mozart), all of Beethoven's symphonies belong to the nineteenth century. His superiority lies not in the fact that he doubled the length of the symphony (which, in truth, was a regrettable mistake); nor does it lie in the discarding of the antique minuet of Haydn and Mozart and the substitution for it of the more modern *scherzo;* nor in the introduction of a chorus in his ninth and last symphony. Wherein it does lie, is clearly hinted at in Sir George Grove's remark anent the *Eroica*, that in this, his third symphony,

> Beethoven first shows himself in his own true colossal proportions, and reveals that extraordinary union of power and tenderness, strength and beauty, humour and pathos, irregularity like the wildness of Nature herself, and obedience no

less strict than hers to the subtlest laws, which have made him so very great and have given him a place in the world beside Shakspere.

The situation in the musical world before Beethoven is admirably summed up by Dr. Hubert Parry in these words:

> The audiences were critical in the one sense of requiring good, healthy workmanship in the writing of the pieces; . . . but with regard to deep meaning, refinement, poetical intention, or originality they appear to have cared very little. They wanted to be healthily pleased and entertained, not stirred with deep emotion;

and the music supplied was in accordance with the demand. Before the nineteenth century, symphonic music was chiefly a toying with pretty musical forms and symmetries — a sort of acoustic kaleidoscope. Beethoven was the first who put the idea and the emotion above the exigencies of form; and if the form did not fit his ideas, he boldly altered it. He was, indeed, much more of an iconoclast than is commonly supposed; but his changes in form are much less significant than the greater stress he laid on expression. Not only are expression-marks much more abundant in his compositions than in those of his predecessors, but his music suffers more if they are not carefully followed. He knew exactly what he wanted, and once wrote in despair that it made him lose all desire to write any more music if his expression-marks were not attended to.

In this exalting of idea and expression above orthodox structure we may discern the dawn of the romantic movement in music. In Schubert the new tendency is more noticeable still. To him the symphonic form was not only not an aid, but an actual impediment, inasmuch as it encouraged him in his one great fault — diffuseness.

Schubert's symphonies (notably the last two) are really groups of orchestral *Lieder* long drawn out. We find in them the same originality and profusion of melodies, the same tenderness, the same stirring harmonies, and touching modulations as in his songs. Harmonically these two symphonies are much more modern than Beethoven's; and in them, too, we find for the first time another nineteenth-century peculiarity—the use of tone-colour for its own sake; lingering lovingly over some ravishing tint as one does over a sunset or the mere colour-charm of a maiden's flashing eyes. Schubert uses the brass, for instance, not for noise, but pianissimo to secure warm, glowing tints; and in general it may be said that, though his orchestra is the same as Beethoven's, he secures from it a much greater variety of tender and beautiful tonal effects. As a revealer of the sensuous charms of orchestral music, Schubert is the direct precursor of Wagner. It may be said here that the nineteenth-century critics and historians, with few exceptions, did not give Schubert full credit for his many-sided originality and epoch-making importance. The twentieth will right that.

Dr. Dvôrák, himself one of the greatest symphonists of the century, places Schubert above Schumann in this line, and far above Mendelssohn. These three were the leaders of the German romantic school. Mendelssohn, however, stood with one foot on the "classical" side, inasmuch as he was not deeply emotional, and elegance and symmetry of form were more important to him than ideas. In this respect one of the last of the symphonists, Brahms, resembled him, though he lacks Mendelssohn's melodic and sensuous charm. Schumann was a romanticist, pure and simple. To him, as to Schubert, the symphonic form was rather an impediment than a help. He distinctly recognised one of its shortcomings—the lack of a musical bond of union between the several movements; and in his Symphony in D he accordingly

tries to remedy this by making the movements run into each other without a stop, and by employing, to some extent, the musical material of one movement in the following ones, so that, as Dr. Parry has remarked, "the series of movements are, as it were, interlaced by their subject-matter; and the result is that the whole gives the impression of a single and consistent musical poem."

Although Dvôrák and others have to some extent followed Schumann's lead in this matter, the symphony has, on the whole, remained to this day as Beethoven left it. What subsequent composers contributed was simply their individual treasures of thought and emotion—which, to be sure, are more important things than mere changes in form. It is noticeable that in the second half of the century Germany's practical monopoly of first-class symphonic writing was broken by two Russians, Rubinstein and Tchaikovsky, and the Bohemian Dvôrák. Rubinstein's *Dramatic* and *Ocean* symphonies are master works, replete with melody and emotion. Tchaikovsky's *Pathetic* has become the most popular symphony of the time; it is one of the most heartrending and profoundly interesting works of the century, an expression of the current pessimism as well as of the agony of unappreciated genius. Of Dvôrák's symphonies the most inspired is the one entitled *From the New World.* It was composed in America, and reflects some of the peculiarities of melodic local colour, as far as it can be said we have any. Of native American composers, Prof. J. K. Paine must be referred to here as a symphonist; and mention may also be made of Prof. Edward MacDowell's *Indian Suite*, which exploits one phase of American local colour, while Dvôrák had his eye on the peculiarities of negro music.

A more characteristic product of the nineteenth century than the symphony—or the modernised suite or overture—is the symphonic poem. Wagner's notion that pure instrumental music has not only reached its climax, but

run its course in Beethoven's symphonies, was disproved by his best friend and warmest admirer, Franz Liszt, as Wagner himself was afterwards obliged to admit. Some historians have credited Berlioz with the invention of the symphonic poem, but that is an error. In his *Romeo et Juliette* and *La damnation de Faust*, Berlioz simply followed the example of Beethoven in enlarging the symphonic form and adding vocal solos and choruses to the orchestra. Liszt also wrote two great works, the *Faust* and *Dante* symphonies, on these lines; but he did a much more important thing, from a formal point of view, when he created the symphonic poem by applying some of Wagner's operatic principles to purely orchestral music.

One of Wagner's principal objections to the opera, as written before him, was that it was a mosaic of musical numbers that had no organic connection with each other. He gave his own operas the desired organic unity by means of the continuous melody and the ever-recurring leading motives. Liszt's reforms were of a similar nature. With the few partial exceptions just referred to, the symphony is a mosaic of four detached and entirely unrelated movements. Liszt had no use for this cut-and-dried sequence of allegro, adagio, scherzo, allegro. In his symphonic poems he changes the tempo whenever and as often as he pleases; there is no break between the several parts, and all are related to one another and flow out of a central poetic idea which is indicated by the titles, such as *Mazeppa*, or *Tasso, Lamento e Trionfo*. The symphonic poem thus enables a composer to write with as great freedom in regard to form as if he were a literary essayist or story-writer. It opens up a new world of instrumental possibilities. France's greatest composer, Saint-Saëns, did not go too far, therefore, when he wrote that the creation of this new form is Liszt's chief title to glory, and that when time shall have

effaced the memory of him as the greatest of all pianists, he will still be honoured as *the emancipator of orchestral music.* Saint-Saëns himself joined the Liszt school in writing four admirably picturesque symphonic poems, and his example has been followed by most modern writers for the orchestra, including Tchaikovsky, Dvôrák, Smetana, Richard Strauss, the Americans Paine and MacDowell, and many others. In these thoroughly up-to-date works we get a glimpse of what the music of the twentieth century is going to be.

Besides emancipating orchestral music from the rigid formalism of the " classical " symphony, the symphonic poem embodies another characteristic trait of nineteenth-century art, inasmuch as it is *programme music.* It is true that crude attempts to make music imitate bird songs or other sounds of nature, or suggest scenes and incidents, were made many centuries ago, from the dragon-fight music of the ancient Greeks to the hailstone chorus of Handel and the animal sounds in Haydn's *Seasons.* But these were sporadic instances, which may be looked on as curiosities, whereas in the nineteenth century programme music, in diverse ways and greatly refined, became of the very essence of the art, affecting all the prominent composers excepting the reactionary and uninspired Brahms. Beethoven's *Pastoral Symphony* has, among other realistic suggestions, a vivid thunderstorm. He appears to have been alarmed by his own audacity in writing such programme music, and made a weak apology for it by cautioning the hearer that he had aimed at an expression of feeling rather than at actual tone-painting. But, as a matter of fact, he admitted that he always had a picture in his mind when he composed; and not long before his death he had a plan of giving appropriate titles to his pieces. Mendelssohn, with all his conservatism, did not hesitate to give his concert overtures, and even his symphonies, suggestive

titles, while his *Midsummer Night's Dream*, with its "tripping elves and braying donkey," is unmistakable programme music. Much of Schumann's music embodies a poetic idea, often pictorial. Raff's *Lenore* and *In the Forest* symphonies are admirable examples of this phase of art, as are the symphonic poems of Saint-Saëns; but it was in the works of Berlioz and Liszt that programme music found its apotheosis. Liszt contented himself with a poetic title and what it suggested, while Berlioz made the mistake of requiring a detailed programme, which it is not always easy to dovetail into the music. Richard Strauss follows him in this respect in his colossal symphonic poems, in which he tries to outdo both Berlioz and Wagner at the same time.

Programme music, to tell the truth, is no longer music unalloyed (absolute music), but a fusion of poetry and music. This fusion of the arts, however, is the very musical essence of the nineteenth century. It goes by the name of "Wagnerism," because Wagner, in his music-dramas, aimed at a union of all the arts, and because his ideas and works affected not only the opera, but all branches of music. So far as poetry and music alone are concerned there was, however, one branch of music in which a thoroughly artistic fusion was achieved before Wagner—in the *Lied*, or lyric art-song, as created by Schubert. As Sir George Grove has remarked in speaking of Schubert's songs: "The music changes with the words as a landscape does when sun and cloud pass over it. And in this Schubert has anticipated Wagner, since the words to which he writes are as much the absolute basis of his songs as Wagner's librettos are of his operas."

The art-song, as created by Schubert, is pre-eminently a product of the nineteenth century. Bach and Handel wrote no real *Lieder*, Gluck's are not worth considering, and of Haydn's and Mozart's only a few foreshadow what

was to come. All these masters were too much absorbed in writing big things—oratorios, operas, symphonies—to put their best ideas into so short a thing as a *Lied*. The same may be said, on the whole, even of Beethoven; so that it remained for Schubert practically to create the art-song as a production of the highest musical rank. His example was followed by Schumann, Mendelssohn, Franz, Brahms, Jensen, R. Strauss, and many other Germans; and while the *Lied* is a specially German product, it has also been cultivated successfully in other countries, by such composers as Liszt, Rubinstein, Tchaikovsky, Grieg, the American MacDowell (who belongs in the front rank of song-writers), and a great many others.

The operatic movement of the last century divides itself into three currents,—the Italian, the French, and the German,—which successively monopolised attention in the order here given. During the first decades Italian opera predominated over everything else, not only in Italy, but in Paris and the German cities, to an extent which is exemplified by the fact that in Vienna, during one whole season (1823), nothing was sung at the Royal Theatre except Rossini's operas! While the composers of the Italian "prima-donna operas"—Rossini, Donizetti, Bellini, and the early Verdi—belong to the first half of the nineteenth century, the spirit of their works is essentially of the eighteenth. That is, their operas do not represent a real fusion of musical and dramatic art, but are music for music's sake, or, rather, music for singing's sake. This tuneful and highly ornamental music became obsolete long before the end of the century, though some of the works still linger in Italian and German repertories. The later Verdi, in *Aïda*, came under French influences and produced a master-work. In his last operas, *Otello* and *Falstaff*, he paid tribute to Wagnerism by bestowing as much care on the text as on the music. Unfortunately,

he had no longer at command his former flow of musical inspiration. The latest " school " of Italian operatic art, the so-called " Veristic " of Mascagni and Leoncavallo, proved a mere ephemeral fad, based on an appeal to the coarsest tastes, dramatic as well as musical.

In French opera the connection between the music and the libretto never was as loose as in Italian opera. Hence it is that Wagner could find hints and precedents in the works of the earlier French composers, such as Grétry, Boieldieu, Méhul, and especially Auber, whose wonderfully inspired *La Muette de Portici* aroused his unbounded enthusiasm, and taught him how to write the pantomimic music which we so much admire in his own music-dramas. These works, belonging mostly to the realm of what the French call *opéra comique* (which is not necessarily comic opera), had their chief vogue in Paris; while the works belonging to the grand opera not only drove Italian opera from the stage in France, but made successful war on it in other countries, until they, in turn, were displaced by Wagner's operas. The origin of this grand-opera school in France goes back to Cherubini and Spontini, and reaches its climax in Halévy and Meyerbeer. Meyerbeer undoubtedly had genius, and a real dramatic vein, but he prostituted them to sensationalism and the desire for immediate success and prosperity. Hence only one or two of his once so popular operas have survived their century; and none of them was so genuinely inspired as the two masterpieces of Bizet and Gounod, *Carmen* and *Faust*, which are the best operas of the century, with the exception of Wagner's and, perhaps, Weber's. Ambroise Thomas, Reyer, Saint-Saëns, Massenet, Delibes, and Bruneau are other prominent composers of French operas of the second half of the century.

In Germany there were great operas before the nineteenth century, notably those of Gluck (who is usually included in the French school because he wrote his best

works for Paris) and Mozart, whose three greatest operas, however, were born only from fifteen to ten years before the beginning of the new century. Beethoven's *Fidelio* (1805) is a great work musically, but of no special importance in the evolution of opera. Not so Weber's *Freischütz* (1821), which is the initial work of the romantic school of German opera. Weber's *Euryanthe* is still more important because of its influence on Wagner. In it may be found the germ of Wagner's cardinal idea that the music should be so closely interwoven with the dramatic poem that the two are inseparable and lose half their beauty if performed apart. Unluckily, Weber had no great poet to co-operate with. Wagner was his own playwright, and his poetic gifts were almost equal to his musical genius. He also had a most remarkable dramatic instinct; and all this enabled him thoroughly to carry out his idea that in the music-drama the drama holds first place, and that the singer should be, first of all, an actor. All his reforms and innovations flow from this principle. The singers were taught a new vocal style, free from embroideries, which always allows the words to be distinctly understood. They had to adapt not only their song, but their gestures, to the orchestral music, which emphasises them at every moment. The orchestra helps the singers to make the text intelligible by means of the leading motives, which mean definite things; the swan motive, for instance, conveying as definite an idea as the word "swan." The orchestra glows in colours of unprecedented richness, now cheerful, now sombre; and in ugly or tragic moments it is not afraid to utter ugly or tragic discords. To secure continuity and coherence, the old operatic mosaic is given up, and instead of elaborate, artificial arias, which are out of place in an opera, we have the continuous melody, which adapts itself to the text at every moment.

In all these respects Wagner has been epoch-making.

He was first abused, then copied and imitated by wholesale in all countries; and to-day it is almost impossible to hear any composition in any department of music without discovering Wagnerian chords and tone-colours. The other opera composers of Germany were practically crushed by Wagner. In Paris, London, or New York, German opera to-day means Wagner opera. It should be added that Wagner's art called into being an entirely new kind of conductors—interpreters rather than time-beaters. Prominent among these were Liszt, Bülow, Richter, Levi, Mottl, Sucher, Schuch, Nikisch, Weingartner, and, in America, Theodore Thomas and Anton Seidl. It also created a new style of singers, among whom may be mentioned Materna, Brandt, Lehmann, Sucher, Malten, Schroeder-Devrient, Wilt, the Americans Nordica and Eames, Tichatschek, Schnorr, Niemann, Vogl, Alvary, Jean and Edouard de Reszké, Van Dyck, Betz, Fischer, Reichmann, Scaria, Kindermann, etc. If we add to these the names of singers famous in other schools of opera—Patti, Nilsson, Sembrich, Melba, Lucca, Trebelli, Sontag, Alboni, Viardot-Garica, Tietjens, Gerster, Malibran, Pasta, Rubini, Reeves, Tamberlik, Duprez, Mario, Capoul, Wachtel, Faure, Gura, Lablache, Tamburini, etc.,—we have a list of vocalists which no preceding century could begin to match.

The comic operas of Lortzing and Nicolai, being less concerned with Wagner's reforms, have retained considerable vogue in Germany. By the side of Wagnerian and other operas there has also been a fine crop of operettas, comic and romantic. Offenbach, Lecocq, Audran, Planquette, in France; Strauss and Milloecker in Austria; Gilbert and Sullivan in England; De Koven and Victor Herbert in America, are the most prominent names. In this branch alone has England done anything of importance. Gilbert and Sullivan not only gave the world an abundance of wit and melody, but they obeyed the

Wagnerian rule that in a stage work the music and the poem should be of equal importance, neither being permitted to assert itself unduly over the others. To this they owed much of their remarkable success. As for Johann Strauss, he was not only the most inspired operetta composer of the century and one of its most fascinating melodists and orchestral colourists, but its "Waltz King." Dance music used to be, for the most part, slow as a stage-coach, because it was intended chiefly for the older folks. Modern dance music is electric and passionate, because it is written for young folks. It is music for the soul as well as the feet. The Strauss waltzes mirror the emotions of modern courtship and love.

In the realm of pianoforte music the nineteenth century again stands pre-eminent. Apart from Bach, who miraculously foreshadowed the modern romantic school, there is little in the eighteenth-century writings for this instrument that satisfies modern taste. The sonatas of Haydn and Mozart seem as small and empty in comparison with Beethoven's as their symphonies. In their wealth of musical thought and feeling Beethoven's sonatas are modern; but their form is antiquated. Paradoxical as it may seem, Beethoven was at once the greatest master of the sonata, and the man who sowed the seeds of its dissolution, as Shedlock has ably shown in his book on the pianoforte sonata. Schumann declared his belief, in 1839, that, while sonatas might continue to be written, "it seemed as if that form of composition had run its appointed course." Even the conservative Brahms, whom Schumann heralded as the musical Messiah, wrote sonatas only in his earliest period, after which he expressed himself in the shorter forms.

In this trend toward short pieces for the piano, Schubert again was the leading spirit. Others wrote short pieces before him, but he was the first who *gave his best*

in them. His *Musical Moments* and *Impromptus* were the forerunners of Mendelssohn's *Songs without Words*, and of the diverse short forms cultivated by Schumann, Chopin, and many others. This devotion to short forms is one of the main traits of musical romanticism. The fact that the romanticists neglected the traditional forms has led many commentators to the absurd conclusion that indifference to form as compared to content was the essence of romanticism. As a matter of fact, the romanticists neglect only the artificial and obsolete sonata form, not form as such. They allow their pieces to crystallise into diverse forms of their own which are more artistic than any sonata mosaic of the " classicists."

Besides this devotion to the " short story," the most characteristic trait of the romantic school is the leaning toward an alliance with poetry,—as in the orchestral symphonic poem,—which we find in most of the great writers from Schumann to MacDowell; Schubert and Chopin being, however, notable exceptions. But Chopin and Schubert were romanticists pure and simple, in that they made the expression of emotion their prime consideration. Chopin is the most idiomatic writer for the pianoforte, and as a harmonist and a revealer of the secrets of that instrument he stands almost as far above others as Wagner does in his own field. Great things, however, were still left to be accomplished by Liszt, Rubinstein, Paderewski, and others, on which the limitations of space make it impossible to dwell. It must be added, however, that the evolution of pianoforte music was dependent on the development of the instrument itself, which is a matter chiefly of the nineteenth century. Americans can revel in the proud thought that in this respect, at any rate, they lead the world. European experts admit that the best pianos and cabinet organs are made in America. American inventions are also the new semi-automatic instruments, which, by enabling anyone to play the most

difficult pieces correctly and with a considerable amount of expression, will, in combination with all the other agencies, do a great deal toward making us a more musical nation in the twentieth century than we have been in the past.

PROGRESS OF AMERICAN ARCHITECTURE

By Russell Sturgis

THE establishment on a firm basis of the present national government is nearly contemporaneous with the beginning of the nineteenth century, and before many years had elapsed the Federal buildings in Washington attracted the attention of historians. Congress met in Washington in November, 1800, as if with expressed determination to be in session there when the new century should begin. At that time, although the capital city had been for ten years decided on and its exact location determined, the only buildings which the Federal Government found ready for its use were a part of one wing of the Capitol and as yet incomplete buildings for the Treasury Department and War Department. The White House was not yet ready for its proposed use as a residence. Nor did these buildings make very great progress, and when they were burned by the British army in 1813 but little loss was suffered.

After the war with Great Britain, the Capitol was rebuilt rapidly, and completed in its original form, as many men now living remember it, with a low central dome and two still smaller domes over what were then the wings occupied by the Senate and the House of Representatives. The White House also was finished in its present form, although the completion of the portico lingered for a time. The "Octagon House," now occupied by the American Institute of Architects, is reputed to have been used by the President during the building

of the White House; the building is not octagonal, however, but of an ingenious and unusual plan well calculated to provide an agreeable residence.

Otherwise, throughout the United States there was but little change or development in the line of architectural art. The Georgian epoch of design had passed, except in the construction of dwelling-houses. A Greek taste prevailed, and an ambition to produce Grecian architecture was uppermost in the minds of all who undertook public buildings. The lyceums or town halls throughout the country, the city halls and court-houses, the State-houses or Capitols, were generally designed with colonnades. Of this nature is the principal building of the college designed under the auspices of Thomas Jefferson, if not by that statesman himself; of this character is the old Custom-house (now the Sub-Treasury) in New York, which is a very faithful copy of a hexastyle Doric temple; and of this character are the Nashville State-house, the Capitol at Montgomery, and a great number of buildings, large and small, in the North as well as in the South, erected at all periods up to the middle of the century. At the same time, however, the dwellings were much more commonly in the grave and decent style which we have generally called "Old Colonial architecture." In this respect New York City was peculiarly fortunate. Whole quarters of the city were thickly built up with houses of the most satisfactory style which has yet been employed in domestic architecture in the United States — or, at least, which has received general acceptance. Many single blocks or isolated buildings throughout that part of the city which lies south of Bleecker Street still remain in their original condition, and in these is to be seen the American domestic architecture of the time before 1835. Of the same years are many interesting houses in the New England towns, as well as in Maryland and Virginia. These houses of the

nineteenth century are often confused with the much older houses which are properly "Colonial," and, indeed, are distinguishable only by the student who will observe the architectural details with some care. The taste for Greek architecture is, it is true, traceable in them in the rather frequent appearance of a colonnade of four or six or, as in one well-known case in Farmington, Conn., of five columns — a nearly unique architectural device. At any time between 1820 and 1850, if a wealthy man wished to build himself a house of unusual stateliness, he would turn the simple domestic " piazza " into a portico of Greco-Roman dignity. Thus in Charleston the Ficken mansion has a hexastyle portico at least as dignified and nearly as large as that of the Custom-house, and a large mansion on South Battery has a Corinthian portico of four columns serving as its entrance porch. With the years beginning with 1835, the houses of the cities became more often large and handsome, with costly mahogany doors, large rooms divided by colonnades of white-painted wood, and very ample and easy staircases — all of them features known to the country mansions, but hardly to city life until that time. Here again New York City is the most important centre of interest, for the houses of Washington Square and those in West Eighth Street (Clinton Place), Ninth Street (Brevoort Place), and East Eighth Street (St. Mark's Place) are very generally of this type, and never since that time have rows of street houses been so well handled or their interiors so well understood. The houses of Boston at this time were as good internally, and had certain peculiarities of plan recommending them to the student, such as the use of the alley passing through and under the house to the back yard, of the utility of which plan much might be said; but their exteriors were generally less noticeable. The narrow and crooked streets and something in the popular taste almost forbade external display

or even elegance. In Philadelphia, on the other hand, severity was caused rather by the strong Quaker influence than by anything in the external character of the town, while the easy access to white marble in considerable quantities made this a favourite material. Hence arose the well-known type of the Philadelphia house, with walls of red brick, white-marble lintels, sills, and door-steps, and, as the houses were built close to the side-walk, without areas and with the entrance nearly on a level with the street, a display of solid, white-painted wooden shutters which carried out the chromic effect to the full.

The cities of the South were less crowded, less busy, more decidedly marked by the distinction between elegant and humble dwellings. In Mobile, Charleston, Savannah, the characteristic dwelling was rather a more stately mansion standing free or nearly so, and having broad verandas or " galleries," which, however, were not turned toward the street, but sidewise upon gardens. Savannah, however, has a very unusual plan: a succession of square, open " places " from each of which four streets lead in four directions, giving a series of square corners and allowing of an irregularity of shape in the house-lots which is not known in our other cities. It is a matter of regret that this plan is not preserved in the newer quarters. The residences in Savannah commonly have windows along their sides opening upon a garden, which, if small, is private, made so by brick walls of sufficient height.

The Gothic revival made itself manifest in the United States at an early date. Few carefully designed buildings in the mediæval styles had been built even in England, when, in 1839, Richard Upjohn took charge of the work on Trinity Church in New York; his task there passing almost immediately into the designing of a wholly new structure, which was finished in 1846. At

about the same time the Church of the Holy Trinity in Brooklyn, which still stands unaltered, was built by Lefevre, whose name is almost forgotten because of his death soon after the completion of this one important work. These buildings were carefully studied from the English Perpendicular style; and as English Gothic hardly included vaulting as a necessary feature, this was wholly omitted in the American examples, though unfortunate afterthought caused some poor imitations of vaulting in woodwork and plaster. Apart from this, the churches were solidly built and with attention to the archæological propriety of every part; the inevitable slips in this direction being caused by the lack of recorded and accessible knowledge in those pre-archæological days.

No form of Pointed style was in common use for other buildings than churches; the same architects who did their best to build Gothic churches preferred to design private and business buildings of different aspect, though there appeared a few buildings which, like Harvard College Library and Yale College Alumni Hall, were reminders of English collegiate Tudor architecture. Upjohn, apart from his Gothic proclivities, was rather famous for his small Italian villas, some of which were of singular grace of design; and A. J. Downing, the landscape gardener, though he occasionally put pointed arches and a steep gable roof to a cottage, carried his Gothic efforts no further than this, and seems to have preferred Elizabethan or some other semi-classic style for the numerous country-houses which he designed. The public buildings of the time just preceding the middle of the century (nearly always of pseudo-Greek style, as has been said above) were unimportant, and have been, in the main, replaced by more impressive structures. The country-houses were also, as a general thing, without marked character, and the rows of street fronts in New York, Philadelphia, and Boston, and in the newer and

rapidly growing cities of the West, were unmarked by architectural intelligence.

In a very few cases a larger house was designed with some faithfulness, preserving a little of the simplicity of the bygone Georgian period, or carefully studied from French Parisian building, or the more tranquil and simple city fronts of Italy. Still, the arrival of the year 1850 found no important architectural movement existing in the country; nor was this year followed by any very marked development. Two or three years later J. Wrey Mould came from England and began to build the Unitarian Church in New York at the corner of Fourth Avenue and Twentieth Street. His design included a lofty and slender campanile, which has never been built; and the church was marked by a character of architectural and sculptured detail and by a logical solidity of structure that are even now not very familiar to American designers. This, however, was Mould's only great chance; his other buildings were comparatively unimportant, and his work in the adornment of Central Park in New York is indistinguishable from that of other artists employed upon the same terraces and bridges. St. George's Church in New York was completed, except for the spires, about 1853, under the direction of Leopold Eidlitz, who succeeded to his former partner and, perhaps, the first designer of the church. This church has since been injured by fire, and altered; but the original scheme, with an undivided and unbroken interior, and a roof supported by carefully designed timber trusses of two patterns, alternating one with another, was one of the boldest and most satisfactory buildings in the United States. The spires were built by Mr. Eidlitz a few years later, and were remarkable as the only pierced spires of Romanesque design known to students; but, unfortunately, the poor quality of the stone caused their removal. The above-mentioned buildings had architectural character,

but the greater part of even the respectable and useful structures of the time were comparatively devoid of it. The Boston Athenæum, with its good plan and really excellent reading-room; the New York Astor Library, the Boston Public Library on Boylston Street, finished about 1858, and some smaller buildings which the Eastern cities managed to pay for during the decade from 1845 to 1855, were generally as devoid of individuality as were the stone-faced hotels and State-houses of the time. During the years from 1845 to 1860 the building of the Southern cities and their immediate neighbourhood was carried on much in their old lines — the lines of the Georgian architecture. What deviation there was from this was still rather in the direction of the supplying of obvious needs. Thus, the houses of Beaufort and of other seaside summer resorts were not unlike English Georgian manor-houses, with this peculiarity, that they were large, with a few spacious, open rooms and wide halls, giving the idea of small and simple English manor-houses increased in scale — a scheme very appropriate to the low latitude and the steadily warm summer weather. New Orleans, most conservative of American cities, showed no change in its outward aspect. The Western cities had received the inoculation of the very evil system of irrational ornamentation which marked also the buildings of the East, as will be stated below.

About 1855, Richard Morris Hunt, having returned from Paris, where he had been a student and also assistant to a prominent Paris architect, built the Studio building in West Tenth Street, and the since-destroyed private house on the north side of West Thirty-eighth Street, putting into these something of that French completeness of plan and of exterior disposition of parts which the country had hardly known before. Hunt also established an atelier on the Paris plan; and half a dozen of the architects most successful and most reputed between 1870

and the close of the century were for a time inmates of that studio. Experiments were tried in those days — experiments both in material and design — which it is sad to see were wholly abandoned during the years which followed. Thus, when Upjohn built Trinity Building in New York, a business building, a mere investment for Trinity parish, he used terra-cotta for the cornice, and by this means obtained a boldness of overhang which he would hardly have dared to give in stone. Terra-cotta had to be imported in those days, or, if not imported, then made by means of a special plant and fired in furnaces erected for the occasion. It is easy to see why the experiment had no immediate results. So in design the churches on Fifth Avenue—that of the Ascension, at the corner of Tenth Street, and the Presbyterian Church three hundred feet farther north, together with the church at University Place and Tenth Street—were all of about this period, and in them was more intelligent designing than generally in the civic buildings of the time; but there was room for more originality in the latter, and the buildings by Hunt above named and a bank in Wall Street by Detlef Lienau held out more promise. Other business buildings of great importance date from this time; two of them were built by Eidlitz in the business section of New York, both of singular solidity and of thoughtful design, which cannot now be judged, as one has disappeared and the other has been altered out of recognition.

The war came, and while some important enterprises took form during those four years of excitement and rapid thought, but little of importance was brought to perfection. The conditions were peculiar; many of the architects and many of their possible employers were in the army; but those who were at home, although often for a short visit only, were full of ambition. So it happened that both industrially and artistically the years

immediately following the war were very active. In the Eastern cities, the domain of business began to encroach rapidly upon that which had been the residence portion, and whole streets were built up with buildings of somewhat pretentious character as to their outsides, the masons and stone-cutters making fortunes out of the simpler work upon so many precisely similar fronts; the residence streets were lined with buildings of constantly increasing cost, and also the construction of country-houses became an important employment for the builders in the smaller towns. A few years were still to elapse before the more important public and private buildings took shape; this was the epoch of much building of less pretension.

The result of the mingling of styles and the clashing of different tastes and fancies was very curious. Philadelphia buildings kept nearer to their old type of red brick and white marble and simple design; Boston buildings were far more often designed by architects employed, each one for a separate building by the owner of the soil. New York, following its unfortunately deeply rooted habit, built itself up in long rows of stores and houses, each for sale to any possible buyer, and therefore of necessity deprived of individual character. And yet the difference in architectural merit of the buildings in the three cities was not so great as might be assumed. The critical students of 1865 abhorred the New York brownstone-front, with its high stoop and its exaggerated affectation of Corinthian elegance, and they envied Boston her intelligent Harvard graduates who owned lots and would build houses for themselves, and who employed other Harvard graduates to design those houses. But Philadelphia and New York, sticking to their traditions, produced at least less that was monstrous and impossible than Boston. There was more intelligence in the Boston building, but there was also more

whim. The dreadful heresy of eclecticism got hold of a few of the Boston men, and the Gothic buttress topped by an Ionic pilaster, a motive which passed into a proverb, was only an extreme case of what was a serious injury to architectural growth. The Gothic revival in the hands of Peter B. Wight, J. Cleveland Cady, Calvert Vaux, Frederick Clarke Withers, and John Sturgis, led to the erection of some important buildings; the Boston Museum of Fine Arts, fronting on Copley Square, being the most florid of these, and embodying the English terra-cotta building of the day. The Academy of Design in New York was the only building ever erected in America in which a serious effort was made to design an abundant sculpturesque decoration on the principles of the more advanced preachers of the gospel of mediævalism. The labour and thought required for such work prevented any immediate following of this example, and it soon appeared that the taste for Gothic buildings was not deeply rooted among the architectural students of the time. Good buildings were designed by the men who have been named, and Richard Upjohn's admirable Trinity Chapel should be added to the list of Gothic churches deserving special praise; but the general effect of the taste for pointed windows and for the ornamentation supposed to belong to them was very unfortunate. It had much to do with what was certainly the most unsatisfactory epoch in American architectural designing. The years from 1865 to 1875 saw the erection by the hundred of the most insufferable country-houses that could be imagined. All architectural sense seemed to have gone out of the designers. The posts of the verandas were cut into shapes suggested by nothing in the world except children's toys; window-heads of hitherto unknown form were put into woodwork, into cast-iron, and even into stone; a variety of roof known throughout the country as the French roof, and consisting of a

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lower slope so steep as to be almost a vertical wall, and an upper slope so flat as to be a mere " deck," produced the ugliest sky-lines conceivable. The country was full of carpenters and masons who thought themselves architects because they had purchased and studied some book containing plans and elevations of famous buildings. These men were trying for originality; but this search, difficult and dangerous even among men who have had previous training in artistic designing, becomes ruinous when followed by the men of an epoch and a country as devoid of artistic sense as those which we are now considering. Buildings were planned without any artistic perception of the necessities of the plan; a room was thrust out to the east and another to the south and another to the west, these different wings having no relation to one another or to the central mass, which, indeed, they might entirely conceal or even destroy.

The same incongruity of design affected also the public buildings of the time. These were the days of Harvard Memorial Hall, of the first and accepted design for the Capitol at Albany, of the United States Government buildings, including post-office and court-rooms in the same huge mass, which were erected in many of the cities of the land, and of very numerous buildings which the designers, if now living, would with perfect propriety disclaim, classing them as the work of their salad days. Men who have since proved themselves capable of much better things produced the most unfortunate designs during those hurried years. The *Tribune* building in New York, the Boston City Hall and Court-house, the earlier public buildings of Chicago, the Connecticut State-House or " Capitol " at Hartford, may all be named with those cited a few lines above as specimens of what ought not to be done in architecture, and yet as the buildings of men who have since proved themselves capable and dexterous. It is, indeed, true that a flood of bad taste

covered the land, and that few detached monuments of some little architectural merit could be seen above it.

A more promising condition of things was seen to exist when the third quarter of the century was completed. In 1875 the older men who were still busy had learned a great deal by experience and by their own blunders; the younger men began to come in, more or less well taught in Paris — at all events certain of the fact that there was such a thing as nineteenth-century architecture and that as yet the United States had hardly achieved it. Henry Richardson was busy as early as 1875, and a very few years later he took up definitely that Romanesque style which he had studied in central France—took it up, and built thereafter according to its doctrine, without forsaking it for a moment. Trinity Church in Boston, partly studied from Spanish models, was one of his Romanesque buildings — perhaps the earliest of them. Nearly contemporaneous with this were three important churches in Boston, one of them by Richardson himself, the others by the younger Upjohn and Cummings and Sears; and several large churches of considerable merit were built in different mediæval styles in New York. The older Upjohn, the designer of Trinity Church thirty-five years before, made of St. Thomas's Church, when rebuilt on Fifth Avenue, his latest and crowning labour. The present writer built many college buildings between 1870 and 1880, and, in connection with George Fletcher Babb, Battell Chapel of Yale College and a bank building in Albany, each of these in a modified Gothic style. Other college buildings, by George B. Post for Princeton College, by H. H. Richardson for Harvard University, and by J. Cleveland Cady in several parts of the country, assisted greatly the advance of style; and Trinity College, near Hartford, was begun on a great scale and in a consistent English Gothic style from the designs of William Burges of London. The admirable buildings of Columbia Col-

lege at Forty-ninth Street, New York, were built by C. C. Haight at a later time, and the same architect built theological seminaries and hospitals in and near New York, all in some form of English Collegiate Gothic. Of younger men, the firm of McKim, Mead & White, who had built the large and interesting dwellings known as the Tiffany house and the Villard-Reid house in New York, designed also the Newport Casino, and in doing this helped much toward a development of country-house architecture which, indeed, has constituted the most important artistic result of the quarter-century. The American frame house, sheathed with clapboards or shingles, is, in the hands of architects of taste, the best thing we have yet to show. A few years later the firm of Carrère & Hastings designed the spirited Spanish-looking palaces used as hotels in St. Augustine. All these buildings had character; but there were still traces enough of the old unarchitectural designing, and this especially in the more important buildings, as is natural. The original designs for the Albany Capitol and for the Philadelphia " Public Buildings " were nearly as devoid of architectural merit as if they had been built forty years earlier.

Since 1885 there have been many more buildings of cost and of great pretension—many more buildings which in scale reached the standard set by the continental nations of Europe—than at any previous time. Club-houses of great importance, dwellings of such cost and dignity that they are really and in every sense of the word palaces, and national and municipal buildings, into the design of which some architectural ambition has found its way, are now so common that even a bare list of them would fill more space than can here be given. If the progress of architecture since that time has not been all that could be hoped, this fact is to be ascribed to the rapid increase of new demands upon the architect's attention. New

problems have developed themselves much more rapidly than the comparatively small number of intelligent architects could work them out. The common use of the elevator made ten-story buildings as easy to administer as the four-story buildings of old time, and the hotels and business buildings were at once changed in this radical way; whereupon it was found that the design which had served for a four-story building was not capable of ready adaptation to the new conditions. Hardly had this been realised and the problem fairly got in hand when the introduction of the steel-cage form of construction revolutionised half the building of the American world anew, and the ten-story front had to be reconsidered for sixteen, eighteen, or twenty stories. Moreover, while the ten-story building, like its predecessors, had been a structure of solid walls carrying iron-framed floors, the steel-cage building was felt to be a totally different construction. Here was a skeleton of uprights and horizontals, and no thoughtful architect could jacket such a structure with a thin stone-faced or brick-and-stone-faced wall without feeling that this was a mere simulacrum of building, and that the real secret of the new design had not yet been discovered. So, too, with the churches; although they were not required to be of unusual height, and although the steel-frame structure hardly suggested itself as fit for them, their condition was felt to be changed by the monstrous height of their neighbours, the insurance buildings, the hotels, the apartment-houses. A church with a two-hundred-foot steeple and a seventy-foot-high roof-ridge made but a poor show alongside of a tower-like mass as large horizontally at top as at bottom, and carrying a level cornice higher than the steeple-cross of the church. Moreover, the architects whose work was of such quality as to please greatly the more instructed part of the community, a community full of a kind of literary intelligence, but without much training

in the arts which address themselves to the eye — those architects found themselves overwhelmed with work. It is not in human nature to refuse a twenty-thousand-dollar or a forty-thousand-dollar commission; it is not in human nature to confess the impossibility of doing so much work and doing it well; the temptation is irresistible to act as if artistical designing were possible to the busy member of a firm in large practice, or if not to him, then to the highly paid assistant. The result is a general tendency toward a method of design which, in the best instances, is markedly controlled by good taste, by the abstention from incongruities and ill-considered details, but which may be almost devoid of the evidences of thought. The colonnade taken bodily from an ancient building, or a theoretical plate in an old book, the evenly spaced windows in a smooth wall, each window capped by a little delicate sculpture, the roof either invisible or of low pitch and masked by a balustrade copied from an Italian palazzo—these and other such architectural members are united without shock and without repulsive incongruity in buildings which do their appointed work quite well—which accommodate a family or a congregation, or which prove to be paying investments—and the community is fairly well satisfied. The extreme rarity of anything novel in design goes with this abrupt explanation of our present state as an architectural community. Mr. Louis Sullivan of Chicago is left alone in his serious and repeated efforts to design the exteriors of lofty steel-framed buildings according to their nature and the requirement of the law and modern custom. A. Page Brown, recently dead, was alone in having a separate and little-known national style in which to build his California College buildings. Heins and La Farge are almost alone in having a large church (the Cathedral of St. John the Divine) put into their hands to be slowly elaborated and perfected in design, even as

the preparatory work progresses. Shepley, Rutan, and Coolidge of Boston are almost alone in having the chance to build a costly and massive structure (the west portal of Trinity Church), with an abundance of representative and ideal figure sculpture forming an essential part of the architectural design. Wilson Eyre has few to help him in his gallant effort to create a truly decorative system of sculpture for buildings which can have but little of it. Sculpture is, indeed, added to a few of our buildings of neo-classic design, just as mural painting is used within, but this without modifying the architectural character of the structures.

The conclusion seems to be that while the artistic mind of the country has well outgrown the period of callow haste and of ill-bred ugliness, it has hardly as yet entered upon a true architectural progress. The possibilities of such progress are evident; moreover, there are artists enough who feel the need of it; but whether the mind of the community, giving its best energies to money-making, will in the course of the next century apply itself with serious purpose to architectural art is, perhaps, as uncertain now as it was in 1850.

PAINTING IN THE NINETEENTH CENTURY

By Kenyon Cox

BESIDES the inherent difficulty of properly estimating contemporary work, there is an especial difficulty in dealing with the painting of the nineteenth century. Art in the past has been traditional, national, and homogeneous; art in our day has been individual, international, and chaotic. At the beginning of the century the so-called "classical revival" destroyed what remained of the traditions of the Renaissance, and almost destroyed the art of painting as such. When men again began to wish to paint, each had to experiment for himself and to find what methods he could. Modern means of communication and modern methods of reproduction have brought the ends of the earth together, and placed the art of all times and countries at the disposal of every artist. The quantity of painting produced has been enormous; the number of individual artists of some distinction has been remarkable; and the succession of "movements" and revolutions, each rapidly extending its influence over the civilised world, has been most puzzling. From this tangled skein it may, however, be possible to pluck a few threads.

Most of the characteristic tendencies of modern painting have had their origin or attained their highest development in France, and France has certainly held the primacy of art in the past century, as did England in the eighteenth, Holland and Flanders in the seventeenth, and Italy in the sixteenth. The history of modern

painting is largely the history of painting in France, and we may safely devote to that country most of the limited space at our disposal. Yet in the first third of the century there is really only one name in France, or, for that matter, on the continent of Europe, that takes high rank. David was a man of force, but neither he nor his followers were painters, and still less were the cartoonists of Germany; Prudhon alone was a really great artist. He was deeply influenced by Correggio, but he had an individuality of his own, and, in spite of the ruin wrought by bitumen, his best canvases are singularly lovely, and of all modern work approach nearest, perhaps, to the power of flesh painting of the old masters. Later the classical school produced another artist of high rank, however little of a painter, in Ingrès. In him the classical tradition was profoundly modified by study of Raphael. He was not a great draughtsman in the sense of mastery of significant form, but he had rare feeling for beauty of line. His drawings are exquisite, and a few of his portraits will prove immortal. His contemporary, Delacroix, was the head of the romantic revolution. This revolution was, however, essentially a literary rather than an artistic movement. Delacroix was a man of great intellectual power, but hardly a greatly successful painter. What he did was to break down the classical tradition and make room for modern art rather than himself to create it. He and his contemporaries were greatly influenced by English painting, and in the first third of the century English painting was still the most vital in Europe. Affected as are the works of Sir Thomas Lawrence, he was still a continuator of the traditions of Reynolds and Gainsborough and, through them, of Van Dyck and Rubens. England was the latest country to be reached by the Renaissance, and the country that longest retained the traditions of painting; and in England the classical school had hardly existed. When painting began to

revive, it was first to England and then to Rubens that it turned for its examples.

The greatest achievement of painting in this century is the creation of modern landscape; and the most singular phenomenon, as Fromentin pointed out long ago, is the extension of the methods of the landscape painter to other branches of art. Now, the history of modern landscape begins in England. Turner cannot be neglected; he was indubitably a powerful and original genius. But he stands alone. It was Constable, the inheritor of the tradition of Gainsborough and of Rubens who first stimulated the study of landscape in France. It was in France that under this stimulus grew up a school of painters of landscape, and of figures and animals in their relation to landscape,—the so-called "Barbizon School," —which produced the art of this century that most nearly equals the great art of the past. If any painters of our day are to be ranked as great masters, these painters are certainly Millet, Corot, Rousseau, and Troyon. The others commonly named with them are so inferior to them that they need not be separately considered. Rousseau's art is founded on Rubens and the Dutch, Corot's on Claude. What they added was a profound study of nature, and particularly of natural light and what painters call "values." Rousseau is naturalistic and rugged, while Corot is lyric. His best work is perhaps the most delicately poetical and beautiful ever produced. In a landscape almost as fine as theirs, Troyon placed cattle and Millet the rustic man. How wonderful, as a pure landscapist, Millet was is perhaps hardly understood. His peculiar distinction is that he was the first painter to study man in nature, and to give the relation of the figure to its surroundings. But besides this modern quality he had in large measure the qualities of all great art. He was a master of simple and dignified composition, a noble colourist, and the greatest master of drawing as expressive

of the action of the human figure since Michelangelo. Perhaps no other master, certainly no other modern master, has shown such capacity to express the essential nature of a movement and to resume it in a permanent type—to paint *The Sower*, not a sower.

The successors of the Barbizon School were those who have been called the " Impressionists." With them the study of light and the painting of everything as if it were landscape reached its extreme. Composition, drawing, even colour for its own sake, were more and more neglected, while the analysis of light became the one essential, and the relations of things seemed vastly more important than the things themselves. Manet, who is generally considered the founder of this school, did not really carry its peculiar manner very far. He began with a rather unsuccessful attempt to paint like Velasquez; in his last days he was influenced by younger men and attempted something like the parti-coloured manner of Monet, but his most characteristic work is blackish in colour, flat, and with heavy outlines. More or less associated with the school was an original painter of considerable power, Degas, but its most influential exponent is Claude Monet. It is he who has carried farthest the experiment of dissecting and recombining the solar spectrum and of producing light by " ocular mixture " of colours. The permanent influence of the school will probably not be very great. It will have somewhat broadened the aims and enriched the palettes of other painters; but its neglects were too many, and it was bound to be succeeded by an art that should again take up the study of beauty, of composition, of form, and of decorative colour.

The great bulk of French painting has always been and still remains academic. The officially recognised painters of France — the medallists and members of the Institute —are generally men of the schools, trained in draughts-

manship, feeble in colour, conventional in composition. Some of them have attained great power and distinction, notably Gérôme, Meissonier, Elie Delauny in his wonderful portraits, and Baudry (who, however, belongs rather with the decorators); but they have added little that was new to art. Their output and that of their followers has been much modified by two influences: that of the great modern exhibitions and that of photography. The "exhibition" is distinctly modern—a child of the nineteenth century. From putting into museums those things of beauty which had outlived their original purpose we have come to make things especially for museums, and to get together temporary museums each year for their exhibition. Hence the gallery picture and the *machine du Salon*. The Barbizon men were often kept out of the Salon, and the Salon had not in their time reached its present proportions. The Impressionists have largely kept themselves out. For those who have regularly participated in the annual exhibitions, the desire to be seen in the crowd has resulted in a steady increase in the size of canvases, with no justification in subject or decorative intention; in constantly growing sensationalism of subject; and, finally, in all sorts of fads and technical extremes.

There have always been naturalists in painting, but photography has shown us, as nothing else ever could, what nature is actually like. Almost with the invention of photography came the Pre-Raphaelite movement in England, a short-lived attempt to abandon all artistic conventions and to substitute for them the painstaking and accurate portraiture of natural fact. A similar ideal attained more nearly its realisation in France at a much later date. With Bastien-Lepage, the tendency to consider man as a part of landscape and the tendency to minute naturalism were combined. The model was posed out of doors, and both the figure and its surround-

ings patiently studied and realised. All fleeting effects had to be abandoned in favour of the grey daylight that alone permits long study in the open air, and composition, style in drawing, and even beauty were sacrificed to fidelity. At his best the result was amazingly like the still unrealised photography in colours. Some of his portraits and pictures are masterpieces in their own way, and before his death he did some beautiful landscapes. With the general mass of painters the influence of photography has been almost wholly for evil, and its result a dead level of commonplace.

Outside of all the schools there have been, meanwhile, here and there, independent artists who have, each in his own way, kept alive this or that quality of more ancient art. Rossetti, more poet than painter, soon abandoned Pre-Raphaelism for a decorative formula and the study of colour and sentiment. His friend and pupil, Burne-Jones, modified while he carried on the Rossettian tradition, and he and his numerous followers have been, in our day, the especial champions of the Florentine ideal of decorative line. Beside them, but apart from them, and tracing his inspiration to the Venetians, was George Frederick Watts. In spite of uncertain draughtsmanship and a fumbling technique, his dignity of composition, elevation of feeling, and occasional grave splendour of colour raise him to a rather lonely height among nineteenth-century painters, and he more often reminds one of the great old masters than any other modern. Gustave Moreau was a sort of French Rossetti, enveloping a purely personal sentiment in a form unlike any other, while in Germany the profoundly original and imaginative genius of Boecklin has kept up the protest against mere realism.

In these men and in others, their contemporaries, the various elements of painting as an art—imagination of subject, beauty of drawing, intricacy of pattern, richness

of colour, gravity and simplicity of tone, even brilliancy of handling and the manipulation of material—have had their exponents. But perhaps the most characteristic phase of the art of the end of the century, in its reaction against naturalism, has been the revival of pure decoration. In England this has led to the arts-and-crafts movement, with its somewhat eccentric mediævalism, and it had its somewhat comic phase throughout the civilised world in the poster mania. Its more serious results have been mainly confined to France and the United States. In France the decorative tradition was never quite lost, and it was revived in its fullest splendour by Paul Baudry in his paintings for the foyer of the Paris Opera House. As a master of significant form, Baudry was one of the greatest of the moderns, and he was a charming colourist also, but he was pre-eminently a master of decorative composition, and, as a vast scheme of ordered line and space for the decoration of a public building, his great work is perhaps the most notable achievement since the Renaissance. His reputation has suffered some eclipse in these later days, but it is safe to predict that it will, sooner or later, shine forth again; and it will be seen that he was none the less a great artist for that academic training which it has been something too much the fashion to decry.

Indisputably, however, the most influential master of decorative painting in the latter part of the nineteenth century has been Puvis de Chavannes. In him, to a noble simplicity and a great feeling for composition, rather in spaces than lines, has been added a strong sense of landscape and a mastery of light and values, so that his work, while as "mural" as Giotto's, is as modern as Monet's. Originally a very fair academic draughtsman, he has come more and more to sacrifice form and detail to monumental gravity and breadth of treatment, until his work, always austere, reaches at last perilously near

to the verge of emptiness and lack of interest. It is always saved by decorative fitness and by great beauty of tone and quiet colour. In our day France has produced much bad decoration as well as some good, but in the Hemicycle of the Sorbonne it has left to future ages an indubitable masterpiece.

America's serious contribution to the art of the world has been made mainly in the last quarter of the century. Our earliest painters were entirely British in training, and some of them became British in nationality as well. Stuart, Copley, West, and Allston are merely second-rate painters of the English school. The influence of France first made itself felt in Hunt, who was a pupil of Couture and greatly influenced by Millet. He was a man of powerful personality, but what he has left behind him is extremely fragmentary. His contemporary, George Fuller, was a self-educated genius who, in spite of an insufficient training, and through a strange technique, gave glimpses of a valid talent. These are the names of greatest importance until the awakening caused by the Centennial Exposition of 1876, and the return to this country shortly thereafter of the American students from Paris and Munich studios. The work of these younger men was, for some time, reflective of that of their foreign masters, and American exhibitions showed in succession the latest fashions of foreign work. The International Exposition of 1900 has for the first time triumphantly demonstrated to the world that a real American school exists, and that it is certainly second only to the French.

Yet of the artists whose work makes up this showing, the two most distinguished are men to whom America can make but slight and doubtful claim. The name of Whistler belongs to the history of art at large rather than to that of art in America. A contemporary of Manet and an exhibitor with him in the famous *Salon des*

Refusés of 1863, he has never returned to America, but has lived in Paris or London, and has lived long enough to see work which was first laughed at now finally accepted as among the most accomplished of the century. Always intensely individual, neither draughtsman nor colourist, and least of all a naturalist, he has devoted his art entirely to refinements of tone and refinements of handling. His work is now as indiscriminately praised as it was formerly attacked, but his best things have an abiding charm, and he is to-day one of the most widely influential of living painters. John Sargent, a much younger man, is even less American than Whistler, for, though of American parentage, he was born abroad and his training was, as his art remains, wholly French. His sense of colour is, like that of most French painters, rather mediocre, and beauty of tone is not especially his province. His distinctive qualities are a profound mastery of drawing, as expressed by planes rather than by lines, and a wonderful manual dexterity. These two qualities, in combination, have made him one of the most brilliant of modern technicians, and, added to them, a strong sense of character has made him perhaps the first of living portrait painters.

No other of the many able and clever Americans residing abroad has reached the degree of distinction attained by these two, nor has any of them, unless it be Mr. Vedder, given any distinctively national or personal note. It has been otherwise with painters who have either remained at home or, once their apprenticeship finished, have returned to this country and have been forced to rely upon themselves. Two Americans, Inness and Wyant, will surely take high rank among the landscape painters of the century: the first a master of passionate and powerful colour, the second a gentler and more delicate nature; both were influenced by the men of Barbizon, yet each struck a note of his own, and each had something

national as well as personal to add to the art of the world. With the landscape painters also may most conveniently be classed one more intensely American than either of these, Winslow Homer. Possessing no foreign training, showing no foreign influence, always himself, Homer has steadily pursued his way, attaining year by year more nearly to his own ideal. His drawing is not always sure, his colouring is rather neutral, his handling is never brilliant, but a strong personality marks everything he does, and figure or landscape is seen with a true artist's vision. No marines ever painted give a greater sense of the weight and power of water than do his, and he has painted some figure-pieces of marvellous vigour. Besides these there stand a whole school of younger men who have absorbed the training of Europe and have felt all contemporary influences, but whose work, in accent as in subject, remains American, and who are to-day the most vital landscape painters in the world. Among them may be specially mentioned D. W. Tyron and Horatio Walker, the first more influenced by French methods, the second by Dutch, but each an individual artist of great force.

That America has something to say in figure painting as well as in landscape is evident when one thinks of the exquisite sentiment of Thayer, the scholarly and clean-cut drawing of Brush, the delicate charm of Dewing, and the brilliant craftsmanship of Chase. In the work of these men and their fellows there is a sincerity, a scorn of sensationalism, a true pursuit of art for its own sake, that are rare in the painting of to-day. Finally, America has done and is doing something interesting and valuable in pure decoration. Years ago John La Farge, whose work in stained glass is as new in kind as it is supreme in merit, so that he may almost be called the inventor of a new art, did some admirable painting in Trinity Church, Boston. After that, little was at-

tempted until the Chicago World's Fair of 1893 gave an opportunity to several of our painters to show what they could do in that line. Since then one public building after another has been decorated with paintings, and the results are familiar to us all. Such men as Simmons, Blashfield, Mowbray, and H. O. Walker have each developed a decorative style of his own, while they have managed to work together and to preserve the general harmony of a great decorative scheme in a way which contrasts most favourably with the decoration of such foreign buildings as the Paris Hotel de Ville or the Pantheon. We have produced no single work of the value of some of those by Baudry or Puvis de Chavannes, but our mural painting has been marked by reticence, dignity, and true decorative spirit.

Since the wave of the Renaissance first started from Italy, the country last reached by it has been the country that at any time has produced the best art. The wave has barely reached us, and it is not impossible that it is to America we must look for the best art of the twentieth century.

EDUCATION AND SCIENCE

THE CENTURY'S GROWTH IN HIGHER EDUCATION

By Franklin Carter

IN considering the progress of the higher education in the United States during the last century, the first impression is one of the marvellous growth in number and resources of the institutions which furnish this education. In 1801, there were but twenty-four colleges or universities in the entire area of the Union. Of these twenty-four schools of learning, New England had eight, — in the order of their foundation: Harvard, Yale, Brown, Dartmouth, University of Vermont, Williams, Bowdoin, and Middlebury. New England had in 1800 less than 1,300,000 inhabitants out of a total population of a little over 5,000,000, having thus more than her proportionate quota of colleges, owing doubtless to the large infusion of university men among her first settlers, especially in the Bay Colony. Of the remaining sixteen, New York had two,—Columbia and Union; New Jersey two,—Princeton and Rutgers (Queens); Pennsylvania two,—the State University and Dickinson; Virginia three,—William and Mary, Washington and Lee, and Hampden-Sidney; Maryland two,—Washington and St. John's Colleges; the District of Columbia one,—Georgetown University; and North Carolina one,—the State University. The surprising thing is that Tennessee, with a population of a little over 100,000, and admitted to the Union only in 1796, had three of these schools of learning. There are probably few educated men, unless they have made a special

study of the higher education, to whom the names of those Tennessee schools are even known. They were Blount College (afterwards University of East Tennessee and finally University of Tennessee), Greenville College (Greenville and Tusculum College, as it is called to-day), and Washington College. The two last-mentioned Tennessee colleges have had a weak and uncertain existence, but did something in enlarging the horizon for many young men and women; indeed, in the early days of Washington College, it gave training to several influential men. The study of these two colleges reveals a story of heroism and pathos. The inspiration that called them into life came largely from two or three men, and was kindled at Princeton. It is a story that has been repeated in all the North-western States by graduates of the New England colleges, except that more frequently the denominational college has not merely held its own, but has come to much influence. To the dominant feeling that learning is the handmaid of religion must be referred the establishment and fine vigorous growth of the denominational college of the West. To the deepening sense of all the people that learning is essential to the highest citizenship (a lesson that the earlier colleges also urged) we owe the magnificent growth of the Western State university.

An immense change has been effected in the relation of our higher schools of learning by the development in transportation. A century ago nearly every higher institution established was intended to benefit its immediate vicinity, and to meet the want which another college, though only a hundred miles away, was supposed to be by reason of its distance unable to satisfy. It was for this reason that Williams, at a distance of only one hundred and ten miles from Yale, was founded and nourished by Yale men. Of the nearly five hundred so-called colleges and universities in our country, it is perfectly safe

to say that at least one half might with economy be abolished or consolidated with some neighbouring institution; but by no means does this imply that some of those which now seem unnecessary have not had an honourable and even an inspiring history.

There were, a year ago, thirty-nine higher schools of learning in the United States, each of which had over one thousand students. The total number in the thirty-nine amounted to about seventy thousand. Of these, only five belong to the twenty-four founded as early as 1800, but those five furnish more than one sixth of the seventy thousand,—in exact numbers, 12,716. It is not more by the striking contrast between the conditions of the strongest of the twenty-four colleges as they were at the beginning and are at the close of this century, than by the large number of well-equipped universities that have sprung into being during the last half of this century, that one is impressed in looking over the field. The solid, original work that some of these later universities are doing could not have been foreseen by an acute observer at the beginning of the century, but the growth of the older schools of learning is of itself amazing. At the beginning of this century Harvard was graduating on an average forty-six bachelors of arts each year; Yale fifty-four, and Dartmouth thirty-four. In the decade beginning 1851 Harvard had risen to eighty-seven, Yale to one hundred and seven, and Dartmouth to fifty-eight. The close of the century finds Harvard graduating as bachelors of arts more than four hundred, most of whom have spent the entire four years of their undergraduate life under her training, though an increasing number of graduates from the Southern and Western colleges spend a year or two at Harvard and obtain there also their bachelor's degree. Although science has been largely admitted to the courses leading to the degree in arts, in 1899 fifty-eight bachelors of science were also graduated from Harvard.

The same year Yale graduated nearly three hundred bachelors of arts, and from her scientific school more than one hundred and forty bachelors of philosophy. The classes entering Dartmouth already number two hundred or more, which number, however, includes candidates for the bachelor's degree in three kinds: arts, letters, and science. The classes in the other more important favourably situated Northern colleges of the original twenty-four show a like increase in numbers, more especially in Brown, Columbia, Princeton, and the University of Pennsylvania. Apparently, location in or near a large city has been a favourable factor in the growth of these schools, particularly with reference to endowments. At the beginning of the century the endowments of the twenty-four colleges were extremely small; most of them had no other resources than tuition fees and annual gifts. To-day the privately supported institutions of the United States possess endowments amounting to more than $100,000,000.

A large part of this expansion has been incidental to the wonderful growth of the country; but the amazing development of our newer States, the transforming of unproductive land into perpetual sources of wealth, the discovery within our borders of great masses of coal, iron, copper, silver, and gold, the magical origin of great cities on areas scarcely denuded of forests—all this has been promoted by the correlation of the discoveries and applications of science with the progress westward of our civilisation. This correlation has stimulated prodigiously the multiplication and the prosperity of the higher schools of learning and, as will be later seen, has revolutionised the curriculum and called into being in our country universities more hospitable to every form of learning than are the oldest universities in the world.

The advance in numbers and resources has enabled the better colleges to increase immensely the opportunities

of instruction; but it is probably equally true that the enlargement of instruction has directly contributed to an increase both in students and in wealth. Whereas, at the beginning of the century, the instruction for candidates for the bachelor's degree was, even in the best-endowed and best-equipped colleges, confined to the ancient languages, mathematics, a little rhetoric and elocution, mental and moral philosophy (as they were called), ethics and theology, and the number of instructors varied from one, the president, to possibly five,—the president, two professors, and two tutors,—now the number of teachers in every well-equipped college with three hundred students will not be less than thirty, and the number of subjects taught, while perhaps still comprised under five or six main departments, will be usually not less than the number of teachers. On all the earlier branches of study the influence of the German university has been profoundly quickening. The frequenting by our brightest young men of the stimulating lecture-rooms and private classes of distinguished German scholars during the last forty years has enlarged the group of ancient languages studied, carrying the Indo-Germanic back to Sanskrit and embracing the Semitic. Under this influence, too, mathematics and philosophy have assumed the largest proportions. But in five directions the college curriculum has been immensely extended; first, in natural science, physics, chemistry, astronomy, biology, geology, paleontology, botany, in which, not to speak with absolute literalness, a new world has been discovered since the beginning of this century; second, in the modern European languages, the importance of whose literatures and the significance of whose relations to all learning have been established for Americans almost within the last quarter of the century; third, in history, which, for the ethical value of its records and for the philosophical significance of its deductions and for the inspiration of

its nobler epochs to the growing student, has at last been recognised, in spite of the hostility of many, as a true humanity; fourth, in political economy, a new science, dismal as it was thought to be in some of its earlier and depressing conclusions, but in the last decade of the century pervaded by a warm philanthropy and promising to prove the handmaid of the purest ethics; fifth, in the English language, which, as an instrument of expression and in its literature and historical development, has taken on dimensions in the modern college of the highest importance. The advance in the first four departments named has been, as it were, the growth of germs, the irresistible, self-guided progress of certain great forces at work in educated minds. I think it not too much to say that the immense strides in the study of English are largely due to the prescience and persuasion of one man, who for more than a quarter of a century, from the presidential chair of the first institution in America, has exerted a commanding influence in favour of educational reform.

It is almost impossible to estimate fairly the immense revolution which the introduction of these departments has created in liberal education in the United States. The consideration of the changes caused by the expansion and invasion of natural science alone are bewildering. The announcement of the Darwinian laws, the introduction of the spectroscope, the detection of new chemical elements, and kindred discoveries gave, about the middle of the century, a great impulse to scientific study. The rapid development of our Western States, the building of railroads and bridges, the opening of mines, all the applications of science to new processes of manufacture and the arts, emphasised the importance of practical education. The splendid careers to which business suddenly opened the way added attractiveness to the new studies. The Civil War in this country and the European wars later,

followed by the immense enlargement of modern armies, all contributed to emphasise the demands of readjustment in favour of science. There has been at times alarm lest the loud claims of science for the investigation of palpable, visible, ponderable substances should abolish the finer studies. That all truth is one; that language and history and literature and sociology could not be destroyed except by the wreck of all studies, including the sciences themselves, is now apparent. But the services which natural science has wrought in the cause of education, and the quickening which her occasional opposition and her frequent example have given to other departments of learning during these years of fermentation, have been invaluable. The introduction of laboratory methods, the requirement that the student should verify or disprove by his own investigation the statement made by his text-book or teacher, the transformation of "knowledge into faculty," as Spencer puts it, the importance of the minutest grain or atom, the enforcement of the infallible honesty of nature—these are features which have given to all studies enlargement, and impart to education in many departments at the opening of the twentieth century a vitality and power of which the wise man a century ago had scarcely a glimmering.

Columbia and Princeton had before the close of the eighteenth century each established an independent chair of chemistry, but the growth of scientific instruction in the first half of the next century was extremely slow. Even at the middle of the century the amount of natural science which a student could secure at the best college in the land was meagre—some chemistry, some physics, and some astronomy, hardly anywhere equivalent to more than an entire half of a year. Some of the lesser colleges were in advance of the larger in this matter. There were two smaller colleges in New England, where the students in the sixties derived not merely a love for

nature, but a mastery of the elementary principles in more than one science, before the end of the sophomore year; but advanced work was practically impossible. It is difficult to judge always from the catalogues as to the number of years during which a science can be pursued, but in all the progressive colleges several of the sciences, not always the same ones, can be studied by whosoever will from two to four years. It will illustrate the great change that has taken place in the rank assigned to natural science if we notice that the general catalogue of Harvard University gives us at the beginning of the century the name of Samuel Webber (afterwards President) as professor of mathematics and natural philosophy. Any other professor who, at that time, could be regarded by courtesy as a professor of science was employed in teaching preparatory to medicine. The undergraduate had then claim to a part of the time of one man for instruction in natural philosophy, and this was true of several colleges in New England. There were last year eighty-nine professors, assistant professors, instructors, and assistants in Harvard University devoted to the teaching of science to undergraduates, either in the academic or the scientific department, apart from those teaching pure mathematics or employed in the Medical School. When Benjamin Silliman in 1802 was appointed professor of chemistry and mineralogy in Yale, it was necessary for him to go abroad to secure instruction to fit him for his work. In 1817, the department of geology was added to his other departments. There was at Yale, as at Harvard, a chair of mathematics and natural philosophy, established in 1770, and held from 1801 to 1820 by Jeremiah Day, who became President of the college in 1817. A year ago science was taught to undergraduates in Yale College by over sixty teachers, not counting the mathematicians or instructors in medicine. It was almost a corollary to the wonderful expansion which physics,

chemistry, astronomy, and biology underwent about the middle of this century that scientific schools should be established, and that in many of the universities, especially in the West, science should receive the largest honour.

It was almost equally a corollary that the languages of the modern European nations, in all of which the fermentation of this new enthusiasm for science was yearly working and developing enormous results, should be lifted into greater importance and secure from our colleges and universities much more attention. The writer, visiting Clark University a few years since (an institution devoted to research and to the training of men for research, honoured all over the world, whose very existence on New England soil is a proof of the revolution which science has introduced into American education), found a number of the advanced scientific students pursuing elementary Spanish. On inquiry, it appeared that a new light in biology (Cajal) had arisen in Madrid, and the eager young biologists were giving a few months to Spanish that they might be able to arrive at the result of his work immediately on publication. The beauty and charm of the modern European languages and literatures had been previously acknowledged. More than one of the older universities had, before the middle of the century, elected a professor in recognition of the fine culture that their study may impart, but the authority of the ancient languages, in its beginning a noble and beneficent but already a prescriptive authority, prevented the full appreciation of the culture to be derived from the study of the perfection of French prose, the lofty, subtle imagination and rhythm of Dante, and the solidity of the German tongue, admirably adapted to metaphysics, but under the touch of Goethe and Heine lending itself to the most delicate lyrical inspiration. But when science came in like a flood she lifted all the languages in which her results were contained to new honour. Thus the

modern languages became practical in a new sense, a sense no longer to be despised. The youth of America entered upon a harvest of opportunity of which it may well be doubted if science secured as large a benefit as the humanities. One may still concede that the modern languages are inferior to the ancient as a means of discipline, or even as fields of exploration, and yet admit that the time wrested by the former from the latter in our higher schools of learning means an immense progress towards the unity of scholars and the triumph of truth, and furnishes to many students of science a touch of finer culture, an appreciation of human genius and of national traits.

The development of transportation and the study of railroading, the growth of our own country as a money-power and the necessary investigation of methods of banking, the collisions of labour and capital, the problems of taxation and tariff laws—these subjects, forced on us as a people, have given a great impulse to the study of the new science of political economy but hardly less to that of the modern languages and history. Not that history should not have ample recognition in every higher school apart from its relations to political economy. Questions of finance are not the only nor the greatest questions that concern the citizens of a republic. They are great questions, but the history of even our own country teaches us that "man does not live by bread alone." The heroic struggles by which these colonies were founded, and by which they were purified of injustices and led into the fine social adjustments of to-day, and, above all, by which the nation was delivered from slavery; the lofty spirits who have guided to these results; the forces and movements of English history which preceded and accompanied these settlements,—ought not an educated American to know these things, and minutely? There has been during the last twenty-five years a new

appreciation of these values. It is easily seen that this field of study may be widely extended as causes are traced to their origin, and the claims for history—constitutional, political, ecclesiastical—amply justify the enlargement in that discipline which in all colleges and universities has taken place. In the University of Chicago, founded in 1890, whose rapid growth, large resources, brilliant faculty, and three thousand students, well illustrate the devotion to the higher learning in this country at the close of the century, there were during the last year thirteen men engaged in teaching history. At the head of this list of teachers has been until very recently the name of the illustrious Von Holst, brought hither from a high position in Germany to teach history in a city of more than a million and a half of inhabitants, which seventy-five years ago did not even potentially exist.

Political economy, and the whole series of interesting subjects relating to society which have grown up in connection with this science, really had no standing in American colleges in the first half of this century. Some hours in the later years were then devoted to its teaching, but the first professors elected in Harvard and Yale to give instruction only in political and social economy were appointed, respectively, in 1871 and 1872. These cognate studies not merely afford the training which bears most directly on citizenship, but, rightly taught, are of the highest disciplinary value. The interest and enthusiasm with which they are pursued in our larger colleges and universities is one of the most striking features in the higher education of to-day. At certain universities, notably at Harvard, these branches can be pursued during the entire college period, and for two years of graduate study, without the repetition of a course.

The expansion in the study of English deserves consideration. English is now studied in all its varieties of

expression, and the correct writing of English is made the aim of a large amount of instruction in the earlier years of the course. It is perfectly safe to say that there are hundreds, if not thousands, of young men at the close of the freshman year in our colleges better fitted to analyse an English sentence and to detect both the excellencies and defects of a great writer than were the students of any classes fifty years ago. This training is considered imperative, and even where the opportunity for election in studies is almost unrestricted, this requirement is maintained. As a result of this, the masterpieces of English are better known by a large proportion of our graduates than ever before, and the knowledge of these models is productive of results. English has at last taken the place in colleges, universities, and graduate schools to which it is entitled. This great reform, so plainly reasonable,—not the least important movement of education in the century,—has not been accomplished without much effort and co-operation among teachers, but, as already stated, is due largely to the genius of one man.

These great additions to the subject-matter of the college curriculum have made the elective system necessary. Though it was adopted from the first in the University of Virginia, opened in 1825, and in some colleges preceded expansion in certain departments, a logical conception unites the introduction of these great changes and the adoption of the principle of election as practically synchronous. We are dealing here with facts and not with theories. The question how far the introduction of this system has strengthened liberal education is not under discussion, though there can be no doubt it has greatly enriched it. The introduction of the system was inevitable. Not without reason the friends of the old system, which did train admirably many young men, regretted and resisted this change, but the preponderance of reason was with this movement, the evolution of the

century. The opening years of the new century will probably see its latitude somewhat abridged. Incongruities sometimes occur at present. When a young man, whose college career has been a series of sudden leaps into and out of very unrelated studies, enters the theological seminary, it may be found that he is not fitted to grapple with the problems that await him; far less fitted than if the old education had not been supplanted. But such cases are rare, and supervision will make them still rarer.

As to the morale of our higher schools one might easily generalise too hastily. But the acceptance of the sound remark of President Eliot that "the still vices are the worst" may keep us from being too sure that, because the occasional rowdyism of the middle of the century has given place in many colleges to a more uniform courtesy and propriety of behaviour, the colleges have made great strides in manliness, while our population has been losing homogeneity. There has been a great increase in the number of students having a large income at their command, and a rapid advance in expenditure for public and private entertainments in college, and the excitement which games beget leads to betting and various excesses. The loss of authority in the home, the decline of reverence, the higher standards of comfort, and the display of wealth combine to create an atmosphere in our cities which fosters the tendency to self-indulgence. Certain arrangements in college societies strengthen this tendency; but no one at all familiar with the young men in our older colleges in this country can fail to know that these colleges have never lost their democratic character, and that simple manhood receives the same respect as ever, and has commanding influence. Finer examples of manliness have never been known in American colleges than have made themselves felt in the last decade. There is more religion among the young men in college than at the beginning of the century.

That there is more proportionately than there was in the middle of the century may, in spite of all organisations, be doubted. But the preaching in most of the universities and larger colleges presents duty and truth in a simpler, more direct, and more attractive form. Revivals have passed; but what religious thinking there is is more persistent and steady. In spite of mighty adverse influences, and with full recognition that the claims for purity and nobility of character which the graduates of the fifties and sixties advance for classmates are not without foundation, it may well be believed that this generation of college boys is not morally inferior to any that has preceded it.

The attention given to physical culture and the development of athletic games has increased the number of students and promoted the general growth, but has without doubt affected the intellectual and the moral tone of the college. Thousands of spectators travelling hundreds of miles to be present at a game, meeting thousands more from the immediate vicinity, all wrought up to the highest pitch of interest; the enormous sums of money expended to witness and support these contests; the exaltation by the press of the heroes of these struggles; the elation or depression which victory or defeat occasions,—these features produce a deep impression on our university life. For the principal actors, the severe training and the development of self-control has its wholesome influence, but the concentration of thought on these events by the entire student body, and sometimes the complete interruption of university work, suggest the doubt whether the intercollegiate competition is not carried to an extreme. Loyalty of spirit and unity of feeling are certainly developed, but one may wonder if these great names do not coincide with the plain tendency in other ways to encourage the military rather than the scholarly spirit.

In addition to the immense expansion in the colleges and professional schools during the last half of the century, the establishment of numerous technical and scientific schools of a high order, already alluded to, attests the sweep of the devotion of the American people to the higher education. The Rensselaer Polytechnic, founded in 1824, was the first of the long and brilliant line. The Sheffield Scientific School, the School of Mines at Columbia, the School of Technology at Lehigh University, the Massachusetts Institute of Technology, the John C. Green School of Science at Princeton, the Sibley School at Cornell University, are only a few of the more eminent of its successors. Schools for training in special subjects are arising in the universities to give training for special careers. Such are the Schools of Pharmacy, Dentistry, Veterinary Surgery, Forestry, Administration, and Finance. The leaven of training is finding its way into many walks of life, and the higher schools of learning are becoming more closely united to the common people.

In graduate schools for the training of teachers, the development of instruction in the department of philosophy and the arts is in the line of true university expansion. To this development the desire of American scholars to keep pace in productivity with the scholarship of the world has largely contributed. The Harvard and Yale schools, growing slowly at first, have come to great importance. The establishment of the Johns Hopkins University in 1876 undoubtedly gave an impulse to this expansion. The Columbia, Pennsylvania, Princeton, and other schools are highly prosperous. It is now possible in certain departments of certain schools to secure a training for the degree of Ph.D. which involves attainments not inferior to those demanded in the best German universities. Only two universities in America are without undergraduate schools. These are Clark University

at Worcester, Massachusetts, and the Catholic University in Washington. The other universities generally represent a congregation of schools, with undergraduates in the departments of science and the arts mounting up in some cases into the thousands. In the older universities the prominent and dominating influences are still with the undergraduate bodies and their teachers. This will be true perhaps for generations, but the presence of hundreds or even of fifty young men, giving themselves with unremitting energy to the prosecution of research and the attainment of the highest scholarship in advanced studies is destined to exert each decade a larger influence on the entire university life. As wealth increases, the number of those who will desire and be able to remain one, two, or three years in the charmed circle of the beloved alma mater will increase. Young men who have earned their first laurels as teachers will return for deeper study that they may teach chosen subjects more thoroughly.

The American people are keenly alive to the value of the higher education. The old four-years' course is now threatened with reduction, not because liberal training is not getting a stronger hold each year, but because some of the professions, notably that of medicine, demand so many years of preparation, including the hospital apprenticeship, from their students, and because it is thought that even greater numbers will secure a degree in arts if the period is shortened. But each year more college graduates are entering into business life. Surely not for these should the period of general training be less. In the general advance of materialism and commercialism from which our people are suffering, this brief survey of the magnificent development of the higher education seems to teach that there is not yet any imperative call for the reduction of the liberal training which has been and still is, next to the Church, the finest exponent and the bravest promoter of a high civilisation.

HIGHER EDUCATION OF WOMEN

By Alice Freeman Palmer

ONE of the most distinctive and far-reaching movements of the nineteenth century is that which has brought about the present large opportunities for the higher education of women. Confining itself to no country, this vast movement has advanced rapidly in some, slowly and timidly in others. In America three broad periods mark its progress: first, the period of quiescence, which ends about 1830; second, the period of agitation, ending with the Civil War; the third, though far as yet from completion, may be called the period of accomplishment.

For the first two hundred years in the history of our country little importance was attached to the education of women, though, before the nineteenth century began, twenty-four colleges had been founded for the education of men. In the early years of this century private schools for girls were expensive and short-lived. The common schools were the only grades of public instruction open to young women. In the cities of Massachusetts, where more was done for the education of boys than elsewhere, girls were allowed to go to school only a small part of the year, and in some places could even then use the schoolroom only in the early hours of the day, or on those afternoons when the boys had a half-holiday. Anything like a careful training of girls was not yet thought of.

This comparative neglect of women is less to be wondered at when we remember that the colleges which

existed at the beginning of this century had been founded to fit men for the learned professions, chiefly for the ministry. Neither here nor elsewhere was it customary to give advanced education to boys destined for business. The country, too, was impoverished by the long struggle for independence. The Government was bankrupt, unable to pay its veteran soldiers. Irritation and unrest were everywhere prevalent until the ending of the second war with England in 1815. Immediately succeeding this began that great migration to the West and South-west which carried thousands of the most ambitious young men and women from the East to push our frontiers farther and farther into the wilderness. Even in the older parts of the country the population was widely scattered. The people lived for the most part in villages and on isolated farms. City life was uncommon. As late as 1840 only nine per cent. of the population was living in cities of eight thousand or more inhabitants. Under such conditions nothing more than the bare necessities of education could be regarded.

But this very isolation bred a kind of equality. In district schools, it became natural for boys and girls to study together and to receive the same instruction from teachers who were often young and enthusiastic. These were as a rule college students, granted long winter vacations from their own studies that they might earn money by teaching village schools. Thus most young women shared with their brothers the best elementary training the country afforded, while college education was reserved for the few young men who were preparing for the ministry or for some other learned profession.

From the beginning it had been the general custom of this country to educate boys and girls together up to the college age. To-day in less than six per cent. of all our cities is there any separate provision of schools for boys and girls. This habitual early start together has made it

natural for our men and women subsequently to read the same books, to have the same tastes and interests, and jointly to approve a large social freedom. On the whole, women have usually had more leisure than men for the cultivating of scholarly tastes.

The first endowment of the higher education of women in this country was made by the Moravians in the seminary for girls which they founded at Bethlehem, Pa., in 1749. They founded another girls' seminary at Lititz in 1794. Though both of these honourable foundations continue in effective operation to-day, their influence has been for the most part confined to the religious communion of their founders. In 1804 an academy with wider connections was founded at Bradford, Mass., at first open to boys and girls, since 1836 limited to girls. From that time academies and seminaries for girls increased rapidly. One of the most notable was Troy Seminary, founded by Emma Hart Willard and chartered in 1819. Miss Willard drew up broad and original plans for the higher education of girls, laid them before President Monroe, appealed to the New York Legislature for aid, and dreamed of establishing something like collegiate training. More than three hundred students entered her famous seminary, and for seventeen years she carried it on with growing reputation. Her address to the President in 1819 is still a strong statement of the importance to the republic of an enlightened and disciplined womanhood.

Even more influential were the life and work of Mary Lyon, who in 1837 founded Mount Holyoke Seminary, and laboured for the education of women until her death in 1849. Of a strong religious nature, great courage and resource, she went up and down New England securing funds and pupils. Her rare gift of inspiring both men and women induced wide acceptance of her ideals of character and intelligence. Seminaries patterned after Mount

Holyoke sprang up all over the land, and still remain as centres of powerful influence, particularly in the middle West and on the Pacific coast.

With this development, through the endowment of many excellent seminaries, of the primary education of girls into something like secondary or high-school opportunities, the period of quiescence comes to an end. There follows a period of agitation when the full privilege of college training side by side with men was demanded for women. This agitation was closely connected on the one hand with the antislavery movement and the general passion for moral reform at that time current; and, on the other, with the interest in teaching and that study of its methods which Horace Mann fostered. From 1830 to 1865 it was becoming evident that women were destined to have a large share in the instruction of children. For this work they sought to fit themselves, and the reformers aided them. Oberlin College, which began as a collegiate institute in 1833, was, in 1850, chartered as a college. From the beginning it admitted women, and in 1841 three women took its diploma. Antioch College, under Horace Mann's leadership, opened in 1853, admitting women on equal terms with men. In 1855, Elmira College was founded, the first institution chartered as a separate college for women.

Even before the Civil War the commercial interests of the country had become so much extended that trade was rising into a dignity comparable to that of the learned professions. Men were more and more deserting teaching for the business life, and their places, at first chiefly in the lower grades, were being filled by women. During the five years of the war this supersession of men by women teachers advanced rapidly. It has since acquired such impetus that at present more than two thirds of the training of the young of both sexes below the college grade has fallen out of the hands of men. In the mean-

time, too, though in smaller numbers, women have invaded the other professions and have even entered into trade. These demonstrations of a previously unsuspected capacity have been both the cause and the effect of enlarged opportunities for mental equipment. The last thirty or forty years have seen the opening of that new era in women's education which I have ventured to call the period of accomplishment.

From the middle of the century the movement to open the State universities to women, to found colleges for men and women on equal terms, and to establish independent colleges for women spread rapidly. From their first organization the State universities of Utah (1850), Iowa (1856), Washington (1862), Kansas (1866), Minnesota (1868), Nebraska (1871), admitted women. Indiana, founded in 1820, opened its doors to women in 1868, and was followed in 1870 by Michigan, at that time the largest and far the most influential of all the State universities. From that time the movement became general: the example of Michigan was followed until at the present time all the colleges and universities of the West, excepting those under Catholic management, are open to women. The only State university in the East, that of Maine, admitted women in 1872. Virginia, Georgia, and Louisiana alone among all the State universities of the country remain closed to women.

This sudden opening to women of practically all universities supported by public funds is not more extraordinary than the immense endowments which during the same period have been put into independent colleges for women, or into colleges which admit men and women on equal terms. Of these privately endowed colleges, Cornell, originally founded for men, led the way in 1872 in opening its doors to women. The West and South followed rapidly, the East more slowly. Of the 480 colleges which at the end of the century are reported by the

Bureau of Education, 336 admit women; or, excluding the Catholic colleges, eighty per cent. of all are open to women. Of the sixty leading colleges in the United States there are only ten in which women are not admitted to some department. These ten are all on the Atlantic seaboard and are all old foundations.

This substantial accomplishment during the last forty years of the right of women to a college education has not, however, resulted in fixing a single type of college in which that education shall be obtained. On the contrary, three clearly contrasted types now exist side by side. These are the independent college, the co-educational college, and the affiliated college.

To the independent college for women men are not admitted, though the grade, the organisation, and the general aim are supposed to be the same as in the colleges exclusively for men. The first college of this type, Elmira (1855), has been already mentioned. The four largest women's colleges — Vassar, opened in 1861; Smith, in 1875; Wellesley, in 1875, and Bryn Mawr, in 1885—take rank among the sixty leading colleges of the country in wealth, equipment, teachers and students, and variety of studies offered. Wells College, chartered as a college in 1870, the Woman's College of Baltimore, opened in 1888, and Mt. Holyoke, reorganised as a college in 1893, have also large endowments and attendance. All the women's colleges are empowered to confer the same degrees as are given in the men's colleges.

The development of co-education, the prevailing type of education in the United States for both men and women, has already been sufficiently described. In co-educational colleges men and women have the same instructors, recite in the same classes, and enjoy the same freedom in choice of studies. To the faculties of these colleges women are occasionally appointed, and, like their male colleagues, teach mixed classes of men and women.

Many co-educational colleges are without halls of residence. Where these exist, special buildings are assigned to the women students.

The affiliated colleges, while exclusively for women, are closely connected with strong colleges for men, whose equipment and opportunities they are expected in some degree to share. At present there are five such: Radcliffe College, the originator of this type, connected with Harvard University, and opened in 1879; Sophie Newcomb Memorial College, at Tulane University, opened in 1886; the College for Women of Western Reserve University, 1888; Barnard College at Columbia University, 1889; the Woman's College of Brown University, 1892. In all these colleges the standards for entrance and graduation are the same as those exacted from men in the universities with which they are affiliated. To a considerable extent the instructors also are the same.

During the last quarter-century many professional schools have been opened to women,—schools of theology, law, medicine, dentistry, pharmacy, technology, agriculture. The number of women entering these professions is rapidly increasing. Since 1890 the increase of women students in medicine is sixty-four per cent., in dentistry two hundred and five per cent., in pharmacy one hundred and ninety per cent., in technology and agriculture one hundred and ninety-four per cent.

While this great advance has been accomplished in America, women in England and on the continent, especially during the last thirty years, have been demanding better education. Though much more slowly and in fewer numbers than in this country, they have everywhere succeeded in securing decided advantages. No country now refuses them a share in liberal study, in the instruction of young children, and in the profession of medicine. As might be expected, English-speaking women, far more than any others, have won and used the

opportunities of university training. Since 1869, women have been studying at Cambridge, England, and since 1879 at Oxford. At these ancient seats of learning they have now every privilege except the formal degree. To all other English and Scotch universities, and to the universities of the British colonies, women are admitted, and from them they receive degrees.

In the most northern countries of Europe—in Iceland, Finland, Norway, Sweden, Denmark—the high schools and universities are freely open to women. In eastern Europe able women have made efforts to secure advanced study, and these efforts have been most persistent in Russia and since the Crimean war. When denied in their own land, Russian women have flocked to the Swiss and French universities, and have even gone in considerable numbers to Finland and to Italy. Now Russia is slowly responding to its women's entreaties. During the last ten years the universities of Roumania, Bulgaria, Hungary, and Greece have been open to women; while in Constantinople the American College for Girls offers the women of the East the systematic training of the New England type of college. In western, central, and southern Europe all university doors are open. In these countries, degrees and honours may everywhere be had by women, except in Germany and Austria. Even here, by special permission of the Minister of Education, or the professor in charge, women may hear lectures. Each year, too, more women are granted degrees by special vote and as exceptional cases.

In brief, it may be said that practically all European universities are now open to women. No American woman of scholarship, properly qualified for the work she undertakes, need fear refusal if she seeks the instruction of the greatest European scholars in her chosen field. Each year American women are taking with distinction the highest university degrees of the continent. To aid

them, many fellowships and graduate scholarships, ranging in value from three hundred dollars to one thousand dollars, are offered for foreign study by our colleges for women and by private associations of women who seek to promote scholarship. Large numbers of ambitious young women who are preparing themselves for teaching or for the higher fields of scientific research annually compete for this aid. Three years ago an association was formed for maintaining an American woman's table in the Zoölogical Station at Naples. By paying five hundred dollars a year they are thus able to grant to selected students the most favourable conditions for biological investigation. This association has also just offered a prize of one thousand dollars, to be granted two years hence, for the best piece of original scientific work done in the meantime by a woman. The American Schools of Classical Studies in Athens and Rome admit women on the same terms as men, and award their fellowships to men and women indifferently. One of these fellowships, amounting to one thousand dollars a year, has just been won by a woman.

The experience, then, of the last thirty years shows a condition of women's education undreamed of at the beginning of the century. It shows that though still hampered here and there by timorous restrictions, women are in substantial possession of much the same opportunities as are available for men. It shows that they have both the capacity and the desire for college training, that they can make profitable and approved use of it when obtained, and that they are eager for that broader and more original study after college work is over which is at once the most novel and the most glorious feature of university education to-day. Indeed, women have taken more than their due proportion of the prizes, honours, and fellowships which have been accessible to them on the same terms as to men. Their resort to

institutions of higher learning has increased far more than that of men. In 1872, the total number of college students in each million of population was 590. Last year it had risen to 1270, much more than doubling in twenty-seven years. During this time the number of men had risen from 540 to 947, or had not quite doubled. The women rose from 50 in 1872 to 323 in 1899, having increased their former proportional number more than six times, and this advance has also been maintained in graduate and professional schools.

The immensity of the change which the last century has wrought in women's education may best be seen by setting side by side the conditions at its beginning and at its close. In 1800, no colleges for women existed, and only two endowed schools for girls,—these belonging to a small German sect. They had no high schools, and the best grammar schools in cities were open to them only under restrictions. The commoner grammar and district schools, and an occasional private school dedicated to "accomplishments," were their only avenues to learning. There was little hostility to their education, since it was generally assumed by men and by themselves that intellectual matters did not concern them. No profession was open to them, not even that of teaching, and only seven possible trades and occupations.

In 1900, a third of all the college students in the United States are women. Sixty per cent. of the pupils in the secondary schools, both public and private, are girls,—*i. e.*, more girls are preparing for college than boys. Women having in general more leisure than men, there is reason to expect that there will soon be more women than men in our colleges and graduate schools. The time, too, has passed when girls went to college to prepare themselves solely for teaching or for other bread-winning occupations. In considerable numbers they now seek intellectual resources and the enrichment of their

private lives. Thus far between fifty and sixty per cent. of women college graduates have at some time taught. In the country at large more than seventy per cent. of the teaching is done by women; in the North Atlantic portion over eighty per cent. Even in the secondary schools, public and private, more women than men are teaching, though in all other countries the advanced instruction of boys is exclusively in the hands of men. Never before has a nation intrusted all the school training of the vast majority of its future population, men as well as women, to women alone. Merely to meet successfully this tremendous venture nothing less than the vast extension which women's education has undergone in our time could suffice.

THE CENTURY'S GREAT MEN IN SCIENCE

By C. S. Peirce

HOW shall we determine that men are great? Who, for instance, shall we say, are the great men of science? The men who have made the great and fruitful discoveries? Such discoveries in the nineteenth century have mostly been made independently by two or more persons. Darwin and Wallace simultaneously put forth the hypothesis of natural selection. Clausius, Rankine, and Sadi-Carnot, perhaps Kelvin, worked out the mechanical theory of heat. Krönig, Clausius, Joule, Herapath, Waterston, and Daniel Bernouilli independently suggested the kinetical theory of gases. I do not know how many minds besides Robert Mayer, Colding, Joule, and Helmholtz hit upon the doctrine of the conservation of energy. Faraday and Joseph Henry brought magneto-electricity to light. The pack of writers who were on the warm scent of the periodic law of the chemical elements approached two hundred when the discovery itself, a most difficult inference, was partly achieved by Lothar Meyer, wholly by Mendeléef. When great discoveries were thus in the air, shall that brain necessarily be deemed great upon which they happened earliest to condense, or the man supereminent who, by the unmeaning rule of priority of publication, gets the credit in brief statements? No, this method of estimation, natural as it is to make success the standard of measure, will not do.

Shall we, then, by a logical analysis draw up an abstract definition of greatness, and call those men great who con-

form to it ? If there were no dispute about the nature of greatness, this might probably prove the most convenient plan. It would be like a rule of grammar adduced to decide whether a phrase is good English or not. Nor would the circumstance that the definition could not be as explicit and determinate as a rule of grammar constitute a serious difficulty. Unfortunately, however, among the few writers who have seriously studied the question, the most extreme differences prevail as to the nature of great men. Some hold that they are fashioned of the most ordinary clay, and that only their rearing and environment, conjoined with fortunate opportunities, make them what they are. The heaviest weight, intellectually, among these writers maintains, on the other hand, that circumstances are as powerless to suppress the great man as they would be to subject a human being to a nation of dogs. But it was only the blundering Malvolio who got the notion that some are born great; the sentence of the astute Maria was : " Some are become great, some atcheeves greatnesse, and some have greatnesse thrust uppon em." Amid this difference of opinion, any definition of greatness would be like a disputed rule of grammar. Just as a rule of grammar does not render an expression bad English, but only generalises the fact that good writers do not use it, so, in order to establish a definition of greatness, it would be necessary to begin by ascertaining what men were, and what men were not, great; and, that having been done, the rule might as well have been dispensed with. My opinion will, I fear, be set down by some intellectual men as foolishness, though it has not been lightly formed, nor without long years of experimentation,—that the way to judge of whether a man was great or not is to put aside all analysis, to contemplate attentively his life and works, and then to look into one's heart and estimate the impression one finds to have been made. This is the way in which one

would decide whether a mountain were sublime or not. The great man is the impressive personality; and the question whether he is great is a question of impression.

The subject admits of much interesting discussion, but the pertinent point here is to confess that the judgments herein expressed have been formed in this way; and if I make general remarks about the great men of the century, these are not deductions from any preconceived principles, but are simply inductions from such pure æsthetic estimations. Although I call them æsthetic, and, no doubt, the "subjective," or personal, factor in them is considerable (but it is, indeed, quite impossible to determine how far they are "objective," that is, representative of the ultimate judgment of posterity), yet I think I am warranted in saying that I have ascertained that a large majority of the educated Americans of the present day would, if thoroughly trained in the practice of this delicate method of pure æsthetic estimation, reach judgments about great men which, if based on the same information, would show a degree of concordance that would surprise most people not a little.

The glory of the nineteenth century has been its science; and its scientific great men are those whom I mean here to consider. Their distinctive characteristic throughout the century, and more and more so in each succeeding generation, has been devotion to the pursuit of truth for truth's sake. In this century we have not heard a Franklin asking, "What signifies a philosophy which does not apply itself to some use?"—a remark that could be paralleled by utterances of Laplace, of Rumford, of Buffon, and of many another well-qualified spokesman of eighteenth-century science. It was in the early dawn of the nineteenth that Gauss (or was it Dirichlet?) gave as the reason of his passion for the Theory of Numbers that "it is a pure virgin that never has been, and never can be, prostituted to any practical application

whatsoever." It was my inestimable privilege to have felt as a boy the warmth of the steadily burning enthusiasm of the scientific generation of Darwin, most of the leaders of which at home I knew intimately, and some very well in almost every country of Europe. I particularise that generation without having any reason to suspect that that flame has since burned dimmer or less purely, but simply because if a word belonged to one's mother tongue, one may be supposed to know unerringly the meaning the teachers of one's boyhood attached to it.

The word *science* was one often in those men's mouths, and I am quite sure they did not mean by it "systematised knowledge," as former ages had defined it, nor anything set down in a book, but, on the contrary, a mode of life; not knowledge, but the devoted, well-considered life-pursuit of knowledge; devotion to Truth—not "devotion to truth as one sees it," for that is no devotion to truth at all, but only to party — no, far from that, devotion to the truth that the man is not yet able to see but is striving to obtain. The word was thus, from the etymological point of view, already a misnomer. And so it remains with the scientists of to-day. What they meant, and still mean, by "science" ought, etymologically, to be called *philosophy*. But during the nineteenth century it was only a metaphysical professor of a now obsolescent type, as I hope, who could sit in his academic chair, puffed up with his "systematised knowledge,"—no true philosopher, but a mere philodoxer. For a snapshot at the nineteenth-century man of science, one may take Sir Humphry Davy, willing, as early as 1818, seriously to investigate the liquefaction of the blood of St. Januarius; or John Tyndall, with scientific ingenuousness proposing that prayer-test to which no clerical Elijah has yet been found with the faith and good faith to respond; or William Crookes, devoting years of his magnificent powers to examining the supposed evidences of the direct

action of mind upon matter, in the face of the world's scorn. Contrast these instances with the refusal of Laplace and Biot, in the closing years of the previous century, to accept the evidence that stones fall from heaven (evidence proving that they do so daily), simply because their prepossessions were the other way. One of the geologist brothers De Luc declared that he would not believe such a thing though he saw it with his own eyes; and a scientifically given English ecclesiastic, who happened to be sojourning in Siena when a shower of aërolites was dashed in broad daylight into an open square of that town, wrote home that having seen the stones he had found the testimony of eye-witnesses so unimpeachable, and so trustworthy that—that he accepted the fact, you will say? by no means—*that he knew not what to think!* Such was the *bon sens* that guided the eighteenth century, —a pretty phrase for ineradicable prejudice.

To this self-effacement before the grandeur of reason and truth is traceable the greatness of nineteenth-century science, most obviously in mathematics. In the minds of eighteenth-century mathematicians their science existed for the sake of its applications. Forgetfulness of this was in their eyes reprehensible, immoral. The question was, What would a given piece of mathematics do? They liked smooth-running and elegant machinery —there was economy in that; but they were not sedulous that it should have symmetry; idle admiration of its beauty they hardly approved. If it was excessively complicated and intricate, that was regarded rather as a feature to be proud of than as a blemish. Were the complete revolution that the nineteenth century wrought upon the ideal of mathematics not notorious, one could soon convince himself of it by looking over almost any modern treatise — say, Salmon on *Higher Plane Curves.* That volume, for example, would be found replete with theorems hardly any of which hold good for any curves

that could really exist. Realisable curves have hardly been studied at all, for the reason that they do not yield a beautiful theory such as is now exacted. Modern mathematics is highly artistic. A simple theme is chosen, some conception pretty and charming in itself. Then it is shown that by simply holding this idea up to one's eye and looking through it, a whole forest that before seemed a thick and tangled jungle of bushes and briers is seen to be in reality an orderly garden. The word *generalisation* really cannot be fully understood without studying modern mathematics; nor can the beauty of generalisation be in any other way so well appreciated. There is here no need of throwing out "extreme cases." Far from that, it is precisely in the extreme cases that the power and beauty of the magic eyeglass is most apparent and most marvellous. Let me take back the word "magic," though; for the reasonableness of it is just its crowning charm. I must not be led away from my point to expatiate upon the reposefulness of the new mathematics, upon how it relieves us of that tiresome imp, Man, and from the most importunate and unsatisfactory of the race, one's self. Suffice it to say that it is so reasonable, so simple, so easy to read, when the right view has once been attained, that the student may easily forget what arduous labours were expended in constructing the first convenient pathway to that lofty summit; what mastery over intricacies, far beyond that of the eighteenth-century master. "It must not be supposed," said C. G. J. Jacobi, one of the simplifying pioneers, "that it is to a gift of nature that I owe such mathematical power as I possess. No, it has come by hard work, hard work. Not mere industry, but brain-splitting thinking—hard work; hard work that has often endangered my health." Such reflections enable us to perceive that if modern mathematics is great, so also were the men who made it great.

The science next in abstractness after mathematics is logic. The contributions of the eighteenth century to this subject were enormous. In pure logic, the doctrine of chances, which has been the logical guide of the exact sciences and is now illuminating the pathway of the theory of evolution, and is destined to still higher uses, received at the hands of Jacob Bernouilli and of Laplace developments of the first importance. In the theory of cognition, Berkeley and Kant laid solid foundations; their personal greatness is incontestable. This is hardly true of Hume. In the nineteenth century, Boole created a method of miraculous fruitfulness, which aided in the development of the logic of relatives, and threw great light on the doctrine of probability, and thereby upon the theory and rules of inductive reasoning. De Morgan added an entirely new kind of syllogism, and brought the logic of relatives into existence, which revolutionises general conceptions of reasoning. The works of Comte, Whewell, J. S. Mill, Jevons, and others upon the philosophy of inductive science were less successful or fruitful. In the more metaphysical part of logic, the philosophy of Hegel, though it cannot be accepted on the whole, was the work of a great man. In metaphysics and general cosmology, the attitude of the century has been expectant. Herbert Spencer has been proclaimed as a sort of scientific Messiah by a group of followers more ardent than philosophic, which does not seem to be gathering strength.

At the head of the physical sciences stands nomological physics. Dr. Thomas Young was here the earliest great man of the century, whose intellect illuminated every corner to which it was directed, taking the first difficult steps in the decipherment of the hieroglyphics, originating the doctrine of colour-mixtures, propounding the correct theory of light and illuminative everywhere. It gives a realising sense of the century's progress that

this great man in its early years should have opined that experimentation in general had then been pushed about far enough. On that occasion, it was not his usual logic, but the eighteenth-century watchword "*le bon sens*," that was his guide, with the sort of result it is continually turning out when used beyond its proper sphere of every-day practical affairs. The advance of years with their experience has led physicists to expend more and vastly more effort upon extreme precision, against every protest of good sense. What has come of it? Marconi's wireless telegraphy, for one thing. For it was the precision with which the velocity of light on the one hand, and the ratio of statical and dynamical constants of electricity on the other, had been determined that proved to Maxwell that the vibrating medium of light was the substance of electricity, a theory that his great follower Hertz applied to making giant light-waves less affected by obstructions than even those of sound. I dare say sapient "good sense" pooh-poohs those wonderful new substances, helium and the rest, that seem the connecting link between ordinary matter and the ether. So it would be useless to point out that their discovery was entirely due to Lord Rayleigh's fastidiousness in the determination of the density of nitrogen. But it has to be noted as a characteristic of the great physicists of the nineteenth century that their reverence for every feature of the phenomenon, however minute, has been in thorough disaccord with the older "good sense." The greatest advances in physics during the century were made by several men at once. Certain ideas would come somehow to be in the air; and by the time they had crystallised for a student here and there, he would hesitate to announce as original conceptions what he had reason to suppose many men shared, while he knew that the larger body would not be yet ready to accept them. Under those circumstances, priority of publication can signify

nothing except haste. Yet, when we come to apply the method of pure æsthetic estimation to the different thinkers who first brought out the mechanical theory of heat, the kinetical theory of gases, and the doctrine of the conservation of energy, we find to our surprise, not that they were none of them great, but that a remarkable crop of great men made its appearance to work out those problems, a fact only explicable by the forest-tree theory. I mean by that, the theory that such an enormous majority of men capable of developing into greatness are kept down by extraneous circumstances, like trees in a forest, that wherever there is room for them they are sure to appear.

Of all men of the century Faraday had the greatest power of drawing ideas straight out of his experiments and making his physical apparatus do his thinking, so that experimentation and inference were not two proceedings, but one. To understand what this means, read *Researches on Electricity*. His genius was thus higher than that of Helmholtz, who fitted a phenomenon with an appropriate conception out of his store, as one might fit a bottle with a stopper. The most wonderful capacity for "catching on" to the ideas of nature when these were of a complicated kind was shown by Mendeléef in making out the periodic law of the chemical elements, as one might make out the meaning of a pantomime, from data so fragmentary—and in some cases erroneous—that the interpretation involved the correction of sundry facts, corrections since confirmed, as well as the prediction of the very peculiar properties of the unknown gallium, scandium, germanium, which were soon afterward actually met with. Minute examination of all his utterances convinces one that Mendeléef's mental processes in this unparalleled induction were largely subconscious and, as such, indicate an absorption of the man's whole being in his devotion to the reason in facts.

A great naturalist, as well as I can make out, is a man whose capacious skull allows of his being on the alert to a hundred different things at once, this same alertness being connected with a power of seeing the relations between different complicated sets of phenomena when they are presented in their entirety. The eighteenth century had its Linnæus, whose greatness even I can detect as I turn over his pages; its Huber, discovering through others' eyes what others could not discern with their own; its Goethe, its Haller, its Hunter; and, mixed with practical greatness, its Pinel and its Jenner. Then there was Lavater, who showed how pure æsthetic estimation might be turned to the discovery of truth,—a man depreciated because logicians and philodoxers can so much more easily detect his weakness than discern his strength. The nineteenth century, with its great thinker Darwin, its Pasteur (great in chemistry as well as in biology, a man who impressed me personally, and impresses me in his works as much as any but two or three of the century), its Lamaroll, Weissmann, Cuvier, Agassiz, von Baer, Bichat, Johannes Müller, Robert Brown, and I know not whom besides, has certainly garnered a magnificent harvest of great men from this field.

Those sciences which study individual objects and seek to explain them upon physical principles—astronomy, geology, etc. (corresponding to history and biography on the psychical side)—demand the greatest assemblage of different powers. Those who pursue them have first to be mathematicians, physicists, chemists, naturalists, all at once, and, after that, astronomers or geologists in addition. It is almost beyond human power. In the eighteenth century, A. G. Werner broke ground in geology, William Herschel, Kant, and Laplace did great things in astronomy. In the nineteenth century, geology was first really made a science, and among its great men one recalls at once Lyell, Agassiz, Kelvin. This country

has become its home. In astronomy, too, this country has been eminent, especially in the new astronomy which has afforded the needed scope for greatness, instead of the narrow rut that Bessel and Argelander had left behind them. Thus it happens that we have a magnificent group of great astronomers living among us to-day. We stand too close to them to take in their true proportions, but it is certain that the names of Chandler, Langley, Newcomb, Pickering, and several others are indelibly inscribed upon the heavens. In England it is only this year that Sir Norman Lockyer has brought the extraordinary research, to which his life has been devoted, to completion, so far as such work can be said to be capable of completion. It is an attribute of its greatness that it is endless.

When we compare all the men I have glanced at, with a view to eliciting a common trait somewhat distinctive of the nineteenth century, we cannot but see that science has been animated by a new spirit, till the very word has become a misnomer. It is the man of science, eager to have his every opinion regenerated, his every idea rationalised, by drinking at the fountain of fact and devoting all the energies of his life to the cult of Truth, not as he understands it, but as he does not yet understand it, that ought properly to be called a philosopher. To an earlier age knowledge was power—merely that and nothing more; to us it is life and the *summum bonum*. Emancipation from the bonds of self, of one's own prepossessions, importunately sought at the hands of that rational power before which all must ultimately bow,—this is the characteristic that distinguishes all the great figures of nineteenth-century science from those of former periods.

THE CENTURY'S ADVANCE IN ASTRONOMICAL SCIENCE

By Simon Newcomb

ONE hundred years ago Sir William Herschel, then in the zenith of his fame, was interesting the learned world by his wonderful discoveries. With his great reflectors he made a step forward in the size and power of the telescope greater than any before or since. Although his greatest and best instrument would be considered extremely imperfect at the present time, those which it superseded were hardly more than what we should now call spyglasses. Herschel was so far the greatest figure of the time in astronomical science, and his work so overshadowed that of his contemporaries on the Continent that the work of everyone else at the time seems unimportant in comparison. Yet not only were great successors of Herschel coming on the stage, but important additions to our knowledge of the heavens were being made outside of England. William Herschel's son John was a lad of eight years. In France, Arago, a boy of fourteen, was fitting himself for the École Polytechnique. At Paris, Lalande, the leading astronomer of France, was actively preparing a catalogue of the fainter stars with an instrument which would now be consigned to the junkshop. But it was the first attempt that had ever been made to determine accurately the positions of the many thousand telescopic stars invisible to the naked eye, and in consequence the *Histoire Céleste* is still one of the classics of the astronomical

investigator. In Germany, Olbers combined the professions of physician and astronomer, and Bessel was a youth of sixteen, clerk in a mercantile house.

The first day of the century was marked by a discovery of capital interest and importance. The wide gap between the planets Mars and Jupiter had been a source of wonder, and the conviction that there must be a planet in it had become so strong that an association of astronomers was formed to search for it. But, on January 1, 1801, before they got to work, Piazzi, the Italian astronomer of Palermo, found Ceres. The year following Olbers discovered Pallas, and propounded his celebrated theory that the newly formed bodies were fragments of a shattered planet, more of which might be found. This anticipation was amply justified by the result, though the theory of a shattered planet has long been rejected. By 1868 the number reached one hundred. When the sky was systematically watched one hundred more were found. When the process of photographing the stars was perfected, so many new ones were found on the photographic plates that it is almost impossible to follow them up. About four hundred and fifty have had their orbits mapped out.

In this country, David Rittenhouse, almost the only American of Revolutionary times who has a place in scientific history, had been dead four years when the century began, and there was no one to take his place. He was one of the committee of the American Philosophical Society that made an extensive and well-planned set of observations on the transit of Venus in 1769. But the period following the Revolution was not favourable to the development of scientific research, and, so far as important additions to natural knowledge are concerned, our country might almost have been counted outside the civilised world. It is curious to trace the development of the scientific spirit among us, in mathematics. A

periodical called the *Mathematical Correspondent* was established by William Lenhart in 1804. The long title states that it is to be adapted to the present state of learning in America. In the preface to the volume, presumably accompanying the first number, it is stated that a number of this work containing one sheet of paper will be regularly published four times a year. In each number a prize question will be proposed, and whoever gives the best solution of that question one month previous to the next succeeding number shall receive a handsome silver medal, on which is the following inscription:

From the editors of the *Mathematical Correspondent* to A— B—, as a reward for his mathematical merit.

Some time during the year it is announced that the prize medal (value $6) has been awarded to Robert Adrain, Reading, Pa., and will be delivered by G. Baron, No. 24 Cedar Street, New York, to any person authorised to receive the same. The problems and questions in the book were about of the order with which a pupil in the high school might now concern himself. The patrons were evidently supposed to know something of arithmetic, elementary geometry, and trigonometry, and to have some idea of Newton's fluxions. This was America's contribution to mathematical science when Laplace, Lagrange, and Euler had done most of their work.

The first American after the Revolution to acquire eminence in any department of astronomical science was Nathaniel Bowditch. A Boston ship-captain by profession, he first prepared his *Navigator*, the standard work of the sailor through most of the century. He mastered the great work of Laplace, and made it accessible to students by a translation and commentary explaining the processes in detail. So far as practical astronomy was concerned, it might be regarded as non-existent among us during at least the first third of the century. We

know little more of it than that Robert Treat Paine, grandson of the signer of the Declaration of Independence, used to compute eclipses and publish the results in the *American Almanac* and the *Boston Advertiser*.

About 1840, Dr. Lardner paid a visit to this country and remained several years, delivering public lectures, which, though not of a high order when measured by the standard of to-day, were much above any our people had then heard. We may take a remark with which he opened one of his discourses as a starting-point from which to measure the progress since made. He announced that the credulity of his hearers would be taxed to the utmost limit when they were told that astronomers were able to weigh the planets. For him this was the last word of astronomy. We may take it for granted that if a hearer had arisen in the audience and said that he not only believed this, but believed that, by the time another generation had passed, men would determine of what substances the sun and stars were composed, and distinguish those which had much iron in their constitution or hydrogen in their atmosphere from those which had not, the lecturer would have replied that he himself could not believe such a thing possible. And yet, it was only a generation before the spectroscope, in the hands of Kirkhoff, Bunsen, and Huggins, was doing this very thing.

But progress did not stop here. Had Kirkhoff or Bunsen been told that in another generation the instrument they first applied to research would be so used that we should discover absolutely invisible planets, revolving around stars, so distant that even the effects they produce in changing the position of the star would be imperceptible in the most powerful telescope,—that not a trace of the effect could indeed be made evident to the vision,—such an outcome might well have seemed incredible even to them. And yet this very thing is being done by our

spectroscopists of to-day. If we could communicate with an inhabitant of one of these invisible planets, we could tell him more of the motions of the world on which he lives than men knew of the motion of our earth before the time of Copernicus.

During the first half of the century, the advance of astronomical science consisted principally in a form of development which goes on without any striking discovery, and therefore has little interest for the general public. When bright comets appeared they were carefully studied by observers, at the head of whom were Bessel and Olbers. It was thus found that the tail of a comet was not an appendage carried along with it, like the tail of an animal, but merely a stream of vapour arising from it and repelled by a force residing in the sun. The discovery of telescopic comets by observers, here and there, continually added to the number of these bodies known. Most of them were found to be moving in such orbits that they would require thousands of years, perhaps tens of thousands, to return to the sun, if, indeed, they ever reappeared. But this, though the general rule, is far from being universal. From time to time comets were found moving in closed orbits and performing their revolutions in periods of a few years, mostly between three years and ten. Several of the orbits passed quite near to that of Jupiter. If, in such a case, the comet and the planet chanced to be together at the point of intersection, the orbit of the former would be completely altered, so that the comet might never be seen again. *Vice versa*, it was found that comets of long period falling from unknown distances in the celestial spaces might be caught, as it were, by the planet Jupiter and set to moving in small orbits with a short period. Thus new comets are from time to time adopted in the solar system, while old ones are liable to fade away and disappear entirely. The last

and best-ascertained case of this kind was in 1886, when a comet was discovered by Brooks, with a period of seven years, which had been made a member of the family by the attraction of Jupiter a few years before. Of more than twenty periodic comets whose orbits have been well ascertained, it is more or less probable that several will never be seen again. The most notable and best-established case of disappearance was that of Biela's comet, which was observed at various returns from 1772 until 1852. During this interval it had performed twelve revolutions. At the returns of 1846 and 1852 it was separated into two parts, and has never been seen as a comet since the latter date.

One of the noteworthy discoveries of the third quarter of the century was that of the relation between comets and shooting stars. The first discovery of this relation came about in a curious way. The researches of H. A. Newton and others had made it quite clear that shooting stars were due to the impact of countless minute bodies revolving around the sun in various orbits and now and then encountering our atmosphere. It was also known that the great November meteoric showers must be due to a stream of such bodies. One astronomer computed the orbit of the November meteors; and another quite independently published the orbit of a comet which appeared in 1866. A third astronomer, Schiaparelli, noticed that the two orbits were practically the same. The conclusion was obvious. The minute bodies which caused the shower moved in the path of the comet and were portions of its substance which had from time to time separated from it. The disappointing failure of the shower in 1899 and 1900 can have but one cause,—a small change in the orbit of the meteoric swarm caused by the attraction of the planets. Nor has the comet associated with them shown itself; it was perhaps dissipated like that of Biela.

Apart from this, the question of the constitution of comets is still an unsolved mystery. Their spectrum is that of a body which shines by its own light. But no one can explain how a body in the cold and vacuous celestial spaces could so shine. The brighter comets may have a more or less massive nucleus. Yet it is not certain that the nucleus is entirely opaque. In 1882, the astronomers at the Cape of Good Hope enjoyed an opportunity which no one of their brethren ever enjoyed before or since: that of seeing a comet enter upon the disk of the sun. Unfortunately, the sun disappeared from view a very few minutes afterward. But not a trace of the comet could be seen on the sun as a spot. It was seemingly quite transparent to the solar rays. That the fainter comets have no nucleus and are merely composed of a collection of foggy particles seems certain. How are these particles kept together through so many revolutions? This question has not yet been satisfactorily answered.

The Greenwich Observatory was taken in charge by Airy in 1834. He immediately instituted a great improvement in its organisation and work, but it was not until 1850 that he acquired for it new instruments of great importance. He was the founder of what has sometimes been called the Greenwich system: the astronomers of an institution taking a part like those of soldiers in an army, making all their observations on a plan prescribed by the authority, and rarely using their own discretion in any way. The mathematical theory of the motions of the planets, and especially of the moon, received its greatest improvement from the hands of Hansen, born about 1795. He may fairly rank as the greatest of celestial mechanicians since the time of Laplace. Towards the middle of the century, he prepared the first tables of the moon which could satisfy the requirements of modern astronomic theory. These were

published by the British Government in 1857, and have now formed the basis of astronomical ephemerides for nearly half a century.

The most striking event of the mid-century period, and one which in the popular mind must long hold its place as among the greatest of intellectual achievements, was the computation by Leverrier of the position of an unknown planet from its attraction on Uranus. The speedy discovery of the planet on the very night it was first looked for was, for the public, a proof of the absolute correctness of gravitational theories that surpassed all others. It was as a first and bold attempt to sail into an unknown sea; yet, as in the case of Columbus and the Atlantic, its repetition would not now be considered a difficult matter.

With the discovery of Neptune and with the advance in the art of astronomical observation, improvements in the theories of the movements of the planets were necessary. The greatest step forward in this direction was taken by Leverrier. Among the results of his work was the discovery that the perihelion of Mercury moves more rapidly than it should under the influence of gravitation. This excess of movement has been abundantly proved by observation since his time, but its cause is still one of the great mysteries of gravitational astronomy.

As a general rule, it may be said that during the last half-century the Germans have been the leaders in astronomical research. Their work on the subject has been more voluminous than that of any other nation. The leading astronomical journal of the world is still that of Germany. But when we consider not quantity of work, but the special importance of particular works, precedence has, from one point of view, passed to America. While, perhaps, we still have fewer students pursuing astronomy in the United States than in Germany, the number of men among us who have acquired the highest distinction

and most skilfully made applications of this science is greater than in any other country. This rapidity of progress from small beginnings is very remarkable.

In 1832, Professor Airy delivered, before the British Association for the Advancement of Science, an address on the progress of astronomy, which soon acquired celebrity. The state of astronomy in different countries was reviewed. America was dismissed with the remark that he was not aware of any observatory existing in that country. In the revival of astronomy among us and its advance to its present position in popular favour, one agency has not been esteemed so highly as it deserves. Contemporaneous with the visit of Dr. Lardner were the lectures of Prof. Ormsby M. Mitchell. With unsurpassed eloquence he explained the wonders of astronomy to audiences intensely interested in the novelties of the subject. From a scientific point of view the lectures were probably not of a high order, nor could it be said that Mitchell himself, active and enthusiastic though he was, was a profound astronomer. Yet it may well be that to him is due the ability of our astronomers since that time to secure the public support necessary to the erection of the fabric of their science.

A few years after Airy's address, little college observatories were founded at Williams College and at the Western Reserve College, Ohio. These were doubtless a stimulus to students, but can hardly have added to astronomical science. When the Wilkes Exploring Expedition was being organised, it was found necessary to have a continuous series of observations made at home during the absence of the expedition which, compared with those made on the ships, would enable the navigators to determine the longitudes of the lands they discovered. A little wooden structure, erected by Captain Gilliss for this purpose, on Capitol Hill, Washington City, was in some sort the beginning of our national observatory.

The actual foundation of the latter was almost contemporaneous with that of the Harvard Observatory, both being commenced about the year 1843. The Harvard Observatory was placed under the direction of William C. Bond, who had, for many years, made observations first at his own house in Dorchester, and then on top of a house at Cambridge. At Washington the Naval Observatory was placed under the charge of Lieutenant Maury. After getting its instruments in operation, he devoted himself almost entirely to those researches on ocean currents, which, so long as the commerce of the world was carried on mostly in sailing vessels, were of the first importance. But the institution soon acquired astronomical celebrity in other ways. Here Sears Cook Walker made the first thorough investigation of the orbit of Leverrier's newly discovered planet, and showed that it had been twice observed by Lalande as far back as 1795, but without its character being suspected. Here also the device of recording the transits of stars by means of the chronograph and determining the longitude of places by telegraph found their first application.

New observatories, some founded in connection with colleges, others by private individuals, now sprang up rapidly among us in every quarter. Twenty-four were enumerated by Loomis in 1856. What figure the number has now reached it is impossible to say. Whatever it may be, it marks rather the interest taken by the intelligent public in astronomical science than the actual progress of knowledge. The number of these institutions which have actually made important contributions to astronomical knowledge is naturally very small. It is to a few leading ones that progress is due.

Two of these have put almost a new face upon astronomical science. These are the Harvard Observatory at Cambridge and the Lick Observatory of California. The former, while a respectable institution from its founda-

tion, and made famous by the works of the Bonds, had never commanded the means necessary to prosecute astronomical research on a large scale. When Pickering assumed the directorship in 1875, he devoted his energies to those branches of research which are now known under the general term of astrophysics, being concerned with the physical constitutions of the heavenly bodies rather than with their motions. The extension of his work was made possible by very large additions to the endowment of the observatory. It thus became one of the best-supported institutions of the kind in the world. Photometry and spectroscopy have been its main subjects. With the aid of a branch establishment in Arequipa, Peru, the magnitudes of all the stars in the heavens visible to the naked eye, as well as many fainter ones, have been determined. Among its remarkable discoveries have been those of new stars. It was formerly known that at long intervals, sometimes more than a century, sometimes less, stars apparently new blazed out in the sky. Really the star was not new, but was an old and very small one, of which the light was temporarily multiplied hundreds of thousands of times. A system of constantly photographing the heavens showed that such objects appear every few years, only they do not generally attain such brilliancy as to be noticed by the unassisted eye.

The success of the Lick Observatory in a different, yet not wholly dissimilar, direction must be regarded as one of the most extraordinary developments of our time. Commencing work about the beginning of 1888, under the direction of Holden, and supplied with the greatest telescope that human art had then produced, the observations of Burnham and Barnard excited universal interest, both among astronomers and the public. The discovery of a fifth satellite of Jupiter, perhaps the most difficult object in the heavens, was made there by Barnard

in 1892. Later, the optical discovery of the companion of Procyon, an object known to exist from its attraction on that star, was made by Schaeberle. But its most epoch-making work is due in recent years to Campbell, by measurements of the motion of stars in the line of sight with the spectroscope.

The possibility of measuring such motions was first demonstrated by Huggins, some thirty years ago, and was applied both by him and by the observers at Greenwich. Then a great step forward was made by photographing the spectrum instead of depending on visible observation. This step was mostly developed by Vogel, at the Potsdam Observatory, near Berlin. In the case of the variable star Algol, Vogel was thus enabled to show that the fading away of its light at regular intervals of something less than three days was really a partial eclipse of the star by a dark body revolving around it. He also showed that three other bright stars varied in their motions to and from the earth in a way that could arise only from the revolution of massive but invisible bodies around them. Now, at the Lick Observatory, Campbell, armed with the best spectrograph that human art could make, the gift of Mr. D. O. Mills, has, by the introduction of every refinement in his method, brought into these measures a degree of precision never before reached. The cases of variable motion, as found by him, are so numerous as to indicate that isolated stars may be the exception rather than the rule. It is true that up to the present time he detects variation in only about one star out of thirteen which he observes. But it is only in the exceptional cases, where the planet is almost as massive as the star itself, that the motion can be detected. It is not at all unlikely that, for every spectroscopic binary system (as these pairs of objects are now called) we can detect, quite a number may exist in which the revolving planet is too small to affect the motion of the star.

Taking a comprehensive view of the future of sidereal research, the most noteworthy feature is the convergence of the most dissimilar lines of investigation toward the greatest of problems, that of the structure of the universe. Unity shows signs of being evolved from what has hitherto seemed an incoherent diversity among tens of millions of bodies. We now look upon the Milky Way not only as a whole in itself, but as forming in some way the foundation of the universe. The telescope and the spectroscope, the balance of the chemist and the diversified apparatus of the physical laboratory, are assaulting the skies, with a prospect of results that no man can yet forecast. Thus, with the beginning of a new century, astronomy, the oldest of the sciences, seems to be entering upon a new career, with a prospect of a life before it the end of which no man can foresee.

THE PROGRESS OF MEDICINE IN THE NINETEENTH CENTURY

By J. S. Billings

THE word "medicine," as used in the title of this paper, includes all branches of the art of prevention and treatment of disease and injuries; all discoveries of methods of diminishing physical pain and of prolonging life, and also that part of modern science which is concerned with accurate knowledge of the structure and functions, normal and abnormal, of the human body, and of the causes of diseases. In other words, it includes not only therapeutics, medical and surgical, but also physiology, pathology, and hygiene.

In all these branches of medicine greater progress has been made during the last century than had been made during the previous two thousand years. This progress has been largely due to improvements in methods of investigation and diagnosis, resulting from increase of knowledge in chemistry and physics; to better microscopes and new instruments of precision; to experimental work in laboratories, and to the application of scientific method and system in the observation and recording of cases of disease and of the results of different modes of treatment. The introduction of statistical methods in the study of cases of disease and of causes of death; the discovery of general anæsthetics; the adoption of antiseptic and aseptic methods in surgery, and the development of modern bacteriology—each marks a point in the history of medicine in the nineteenth century.

The scientific demonstration that some diseases are due to the growth and development of certain specific micro-organisms in the human body dates from about twenty years ago, although the theory of such causal relation is much older. Since 1880 it has been proved that anthrax, Asiatic cholera, cerebro-spinal meningitis, diphtheria, one form of dysentery, erysipelas, glanders, gonorrhœa, influenza, certain epidemics of meat-poisoning, pyæmia and suppuration in general, pneumonia, tetanus, relapsing fever, tuberculosis, bubonic plague, and typhoid fever are due to minute vegetable organisms known as bacteria; that malarial fevers, Texas cattle fever, and certain forms of dysentery are due to forms of microscopic animal organisms known as microzoa; and for most of these diseases the mode of development and means of introduction of the micro-organism into the body are fairly well understood. To the information thus obtained we owe the triumphs of antiseptic and aseptic surgery, a great increase of precision in diagnosis, the use of specific antitoxins as remedies and as preventives, and some of the best practical work in public hygiene.

The evidence as to the increased powers of medicine to give relief from suffering and to prolong life is most clear and direct in the records of modern surgery—particularly in some of its special branches. In a large proportion of certain cases in which the surgeon now operates with a fair chance of success, such as calculus in the kidney or gall-bladder, shot-wounds of the abdomen, and tumours of various kinds, there was no hope in the year 1800, and the unhappy sufferer could only expect a certain, though often a lingering and painful, death. In cases of cancer of the face, tongue, breast, or uterus, the persistent pain, extreme disfigurement, and offensive odours which attended them made death a boon to be prayed for, if not deliberately sought, while now such cases, if brought in time to the surgeon, can often be entirely relieved. The

knowledge of this fact has become general with the public, and patients no longer defer an operation as long as possible, as was their custom in days of old. Instead of having to look forward to the torture of incisions, manipulations, and stitching, with but small hope of surviving the exhausting suppuration and blood-poisoning which were such common results, the patient now knows that he will inhale a little sweet vapour, and sleep unconscious of the strokes of the surgeon's knife or the pricks of his needle. He may dream wondrous dreams, but he will soon awake to find himself in his bed staring at the trained nurse standing by his side, and wondering vaguely why the operation has not begun. He does not have to look forward to weeks and even months of daily dressings. The surgeon will glance at his temperature record and at the outside of his bandages, but will probably not touch them for a week; and when he does remove them nothing will be seen but a narrow red line without a trace of suppuration. These improved methods not only preserve the mother for her children, and the bread-winner for the family, but they greatly contribute to the public good by shortening the period of enforced idleness and unproductivity after operations.

Some of the greatest triumphs of modern surgery are obtained in cases of disease or injury of the abdominal organs. The removal of ovarian and uterine tumours is now so common and successful that it is not easy to realise that a hundred years ago there was practically no help or hope for such cases. In former days, the lists of deaths contained many cases reported as inflammation or obstruction of the bowels, or as peritonitis. It is now well understood that most of these cases are due to disease of a little worm-like appendix connected with the large intestine on the right side of the lower part of the abdomen, inflammation of which, known as appendicitis, causes excruciating pain, and often produces internal

abscesses and death. An operation for the removal of such a diseased appendix is now common and, in most cases, successful. The operation for the removal of calculus, or stone, from the urinary bladder dates from over twenty-five hundred years ago, and no one knows who first performed it. Within the last century it has been largely superseded by an operation which crushes the stone to powder within the bladder, and removes this powder without the use of the knife. The removal of calculi from the kidney or from the gall-bladder, and the removal of a diseased kidney are new operations, made possible by improved means of diagnosis, anæsthesia, and antisepsis. Wounds of the intestines were formerly thought to be almost necessarily fatal, and nothing was done for them except to stupefy the patient with opium. Now in such cases the abdomen is opened, the lacerations of the bowel are closed, the effused blood and other matters are removed, and in many cases life has thus been preserved.

By increase of knowledge of the anatomy of the brain, and of the distribution of nerves connected with it, it has become possible in a certain number of cases to determine what part of the brain is suffering from irritation or pressure, and to operate for the removal of the tumour or other substance causing the trouble, with considerable hope of giving permanent relief. A branch of surgery which has developed into an important specialty during the last century is that known as plastic and orthopædic surgery. The replacing of a lost nose by engrafting other tissue in its place is a very old triumph of surgical art, but operations of this kind have been greatly extended and perfected within the last hundred years, and much can now be done to mitigate the deformity and weakness due to club feet, bandy legs, contracted joints, etc., which formerly were considered to be beyond remedy.

Many of the diseases peculiar to women have been deprived of much of their terrors within a hundred years. In 1800, for every thousand children born, from ten to twenty mothers died. Puerperal fever occurred in epidemics, following certain physicians or nurses, but nothing was known as to its causes or nature. To-day puerperal fever is almost unknown in the hospitals or in the practice of a skilled physician. The death-rate of mothers is less than five per thousand births, and the mechanical obstructions which a century ago would almost certainly have brought about the death of both mother and child are now so dealt with that more than half of both mothers and children are saved.

The study of the diseases of the eye has greatly developed another specialty during the century, viz., ophthalmology. The investigations of Helmholtz in physiological optics, with his invention of the ophthalmoscope in 1852, effected a revolution in this branch of medical science and art, and have added greatly to human comfort and happiness. A hundred years ago, when the physician saw the eyelids of the new-born babe redden and swell, and yellow matter ooze from between them, he knew that in a few days or weeks the child would be partially or wholly blind, but he knew nothing of the simple means by which the skilled physician can now prevent such a calamity. It is unfortunately true that this knowledge is not even now sufficiently widely diffused, and that our blind asylums must, for some time to come, continue to receive those have been deprived of sight during the first months of their life through the ignorance or neglect of those who should have properly cared for them.

While it is certain that the death-rates in the last century were greater than those of the present day, it is not possible to make precise comparisons. The record of deaths in the city of New York begins with 1804,

and was necessarily very imperfect until the law of 1851, which required the registration of all deaths; but it shows a death-rate of 30.2 per 1000 in 1805, which means that the true death-rate must have been between 35 and 40. At present, for a series of five years, it would be about 20, having been below 19 in 1899, so that the death-rate has been diminished by at least one third. How much of this is due to improved methods of treatment, and how much to improved sanitary conditions, it is impossible to say. A comparison of the list of causes of death in 1805 with the list of causes for 1900 shows great differences, but much of this is due to changes in name and to more accurate diagnosis.

"Malignant sore throat" and "croup" were well known to anxious parents in 1800, but "diphtheria" caused no anxiety. "Inflammation of the bowels" was common and fatal, but "appendicitis" had not been heard of. "Nervous fever," "continued fever," and "low fever" were on the lists, but not typhoid, which was not clearly distinguished as a special form of disease until 1837, when Dr. Gerhard, an American physician, pointed out the differences between it and typhus, which also prevailed at the commencement of the century.

One hundred years ago the great topic of discussion in our cities on the North Atlantic coast was the means of preventing yellow fever, which had been epidemic in New York and Philadelphia for two years. Physicians were disputing as to whether the disease was contagious and imported, and therefore, perhaps, preventable by quarantine and disinfection, or was due to some occult condition of the atmosphere (which was the view taken by Noah Webster in his *History of Epidemic and Pestilential Diseases*, a work which appeared about the middle of the year 1800, although it is dated 1798). The discussions remind one of the remark that a certain patented form of electric light was surrounded by a cloud of non-

luminous verbosity. For example, the Committee of the Medical Society of the State of New York reported that yellow fever may be produced in any country by pestilential effluvia; and Webster concluded that typhus and nervous fevers were due to a "conversion of the perspirable fluids of the body into septic matter"—all of which means that they knew nothing about it. Even now we do not know the cause of yellow fever, or the precise mode of its spread; but we are sufficiently certain that it is due to a specific micro-organism to be confident that its spread can be checked by isolation and disinfection properly applied—and Memphis and New Orleans are witnesses to the truth of this.

In the year 1800, the majority of persons over twenty years old were more or less pitted by smallpox, being the survivors of a much greater number who had suffered from this disease. Dr. Miller in New York had just received from England a thread which had been steeped in the newly discovered vaccine matter, and was about to begin vaccination in this city. To-day there are many physicians who have never seen a case of smallpox, and a face pitted with the marks of this disease is rarely seen. During the century there have appeared in civilised countries two strange and unfamiliar forms of epidemic disease, namely, Asiatic cholera and the plague, the first coming from the valley of the Ganges, the second from the valley of the Euphrates, and each having a long history. A really new disease was the outbreak in Paris in 1892 of a specific contagious disease transmitted from sick parrots, and known as psittacosis. This little epidemic affected forty-nine persons, and caused sixteen deaths. Typhus fever has almost disappeared, while some diseases have increased in relative frequency, in part, at least, because of medical progress. The children who would have died of smallpox in the eighteenth century now live to be affected with diphtheria or scarlet

fever, and the increase in the number of deaths reported as due to cancer is partly due to the fact that a greater proportion of people live to the age most subject to this disease.

A large part of modern progress in medicine is due to improved methods of diagnosis, and to the use of instruments of precision for recording the results of examinations. The use of the clinical thermometer has effected a revolution in medical practice. Our knowledge of diseases of the heart and lungs has been greatly expanded during the century by ausculation and percussion, and especially by the use of the stethoscope. The test-tube and the microscope warn us of kidney troubles which formerly would not have been suspected, and the mysterious Roentgen rays are called in to aid the surgeon in locating foreign bodies and in determining the precise nature of certain injuries of the bones. Bacteriological examination has become a necessary part of the examination in cases of suspected diphtheria, tuberculosis, or typhoid, and a minute drop of blood under the microscope may furnish data which will enable the skilled physician to predict the result in certain cases of anæmia, or to make a positive diagnosis as between malaria and other obscure forms of periodic fever.

The means at the command of the physician for the relief of pain now include, not only the general anæsthetics,—chloroform, ether, and nitrous oxide,—but also the hypodermic use of the concentrated alkaloids of opium, belladonna, and other narcotics, and the local use of cocaine; and restful sleep for the weary brain may be obtained by sulphonal, chloral, etc. Some agonising forms of neuralgic pain are now promptly relieved by the section or excision of a portion of the affected nerve; or it may be forcibly stretched into a condition of innocuous desuetude. Relief to the sufferings of thousands of neurotic women, and of their families and friends, has

been produced by the systematic scientific application of the rest cure of Dr. Weir Mitchell.

A hundred years ago the medical advertisement which was most prominent in New York and Philadelphia newspapers was one of a remedy for worms. Many symptoms of nervous and digestive troubles in children were in those days wrongly attributed to worms. Nevertheless, there is good reason to believe that parasitic diseases derived from animals were in those days much more prevalent in this country than they are to-day. Our knowledge of the mode of origin and development of the tapeworm, the *trichina spiralis*, the liver fluke, and the itch insect has been gained during the nineteenth century. Much the same may be said with regard to the peculiar worm known as *anchylostum*, the cause of Egyptian chlorosis and of the St. Gothard tunnel disease, although prescriptions for this parasite are found in the Papyros Ebers, written before the time of Pharaoh.

The limits of this article permit of but a brief reference to the progress in preventive medicine during the century. The studies made in England of the results of the cholera epidemic of 1849, and the experience gained in the English army during the Crimean war, led to some of the most important advances in sanitary science, more especially to the demonstration of the importance of pure water supplies, and of proper drainage and sewerage. During our Revolutionary war, and the Napoleonic wars, the losses to the armies from disease greatly exceeded those from wounds; and hospital fever—in other words, typhus— was dreaded by a general almost more than the opposing forces. During the wars of the last twenty-five years, typhus and hospital gangrene have been unknown, but some extensive outbreaks of typhoid fever have occurred, showing that our knowledge of the causes and mode of transmission of this disease has not been practically applied to the extent to which it should have been;

this remark applies also to some of the most fatal diseases in civil life. In the United States, diphtheria and typhoid fever each causes from twenty to thirty thousand deaths a year, while more than one hundred thousand deaths are annually due to consumption. Yet for each of these diseases we know the specific germ, the channels through which it is usually conveyed, and the means by which this conveyance can be to a great extent prevented. The ravages of these diseases are, therefore, largely due to the fact that the great mass of the people are still ignorant on these subjects. Antitoxin is not yet used for either prevention or treatment in diphtheria to anything like the extent which our knowledge of its powers demands.

Our better knowledge of the causes of certain infectious and contagious diseases, and of the mode of their spread, has been of great importance to the world from a purely commercial point of view, since it has led to the doing away with many unnecessary obstructions to traffic and travel which were connected with the old systems of quarantine, while the security which has been gained from the modern method of cleansing and disinfection is decidedly greater than that secured by the old methods. A striking illustration of the effect of these improvements is seen in the manner in which the news of the recent outbreak of plague in Glasgow was received in England and throughout Europe. One hundred years ago the city would have been almost deserted, and terror would have reigned in all England. To-day it is well understood that the disease spreads by a bacillus which is not conveyed through the air. No one fears a repetition of the ghastly scenes of the Black Death in the fourteenth century. In like manner, and for the same reasons, Asiatic cholera has lost most of its terrors.

The benefits to the public of modern progress in medicine have been greatly enlarged by the establishment of

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many small hospitals, and by the steady increase in the employment of specially trained nurses in private practice, even in rural districts. The result of a case of typhoid or of pneumonia often depends as much upon the nurse as upon the doctor; and affection cannot take the place of skill in either. For the great mass of the people, cases of severe illness or injury, or those requiring major surgical operations, can be treated more successfully in well-appointed hospitals than in private houses, and as this is becoming generally understood the old feeling against entering a hospital for treatment is rapidly disappearing. Improvement in hospital construction and management has kept pace with progress in medical knowledge; and in future such institutions seem destined to play an increasingly important part in municipal and village life.

All progress in civilisation is attended with injury to some individuals. Trained nurses have deprived some unskilled labour of employment; hospitals have injured the business of some physicians; pure-water supplies, good sewers, food inspection, vaccination,—in short, all effective measures in public hygiene,—interfere with the trade side of medical practice; but upon the whole the public at large benefits by all these things. In one sense they seem opposed to the general law of evolution, in that they prolong the life of the unfit; but in a broader sense they work in accordance with this law by increasing the power of the strong to protect and care for the weak.

All told, the most important feature in the progress of medicine during the century has been the discovery of new methods of scientific investigation, more especially in the fields of bacteriology and pathology. These methods have been as yet only partially applied, and great results are to be hoped from their extension in the near future. They will not lead to the discovery of an elixir of life, and the increasing feebleness of old age will

continue to be the certain result of living a long time, for the tissues and organs of each man have a definitely limited term of duration peculiar to himself; but many of the disorders which make life a burden in advancing years can now be palliated, or so dealt with as to secure comparative comfort to the patient, so that "if by reason of strength" life can be prolonged beyond threescore years and ten it no longer necessarily involves labour and sorrow.

SCOPE AND TENDENCIES OF PHYSICS

By Oliver Lodge

THE chief scientific event at the beginning of the past century was the discovery of the electric current by Volta. This discovery opened a new chapter in physical science — a chapter which has now become a book of many volumes. But it is within the latter half of the century, and since the discoveries of Faraday, that its extreme importance has been recognised; and it is within the last twenty-five years that its direct application on a large scale to ordinary human existence has begun. Already the applications of the electric current to human life bid fair to rival those of steam, if they do not already surpass them. Every telegraph and telephone message, every dynamo current, depends on the discoveries of Volta and Faraday. It is impossible to overestimate the gain to humanity of the work of some quiet seeker after truth who happens to be favoured with success in that quest. From his time onward the benefit gradually increases, until it becomes so incorporated with their lives that people cease to think of it, accepting it in the unheeding way they accept the sun, and the air, and the soil. It is perhaps for this reason that they make so little effort to encourage a purely scientific explorer; they do not realise that facts which seem at first small and insignificant may bring forth fruit a thousandfold, and that whereas those who exploit and apply them usually need no encouragement beyond that which they freely receive, the original discoverer may be hampered and hindered in

his work by the penury which accompanies non-recognition. It was the uniquely endowed laboratory of the Royal Institution, London, which enabled Faraday to realise his genius. Men able to experiment are not lacking: laboratories, research laboratories, and leisure to employ them, are the urgent need of all countries at the present time.

But although the foundations of modern electricity were being laid at its beginning, scientific progress during the first quarter of the century lay chiefly in the domain of optics. The mathematical possibilities of the wave theory of light kindled enthusiasm in the great physicists of that day, and discoveries of the utmost brilliance in optics were rapidly made. The names of Young and Fresnel and MacCullagh stand out luminously in this period, as does that of Huyghens in the epoch immediately preceding. The investigation of interference and diffraction, and the discovery of polarised light, are not so widely appreciated as work of less merit in some other departments is; nevertheless, not only were the highest mathematical and experimental powers required for their elucidation, but there is a completeness and finish about these researches hardly to be found anywhere else, except in the dynamical theory of astronomy, the theory which we owe to Newton. It was probably this completeness and finish which delighted and satisfied the great French physicists of the period; and to them in great part our knowledge of the highest refinements of optics is due. The wave theory of light was not, however, strictly speaking, dynamical; that is to say, it was not directly based upon Newton's laws of motion and the straightforward mechanics of matter. Indeed, the actual dynamical basis of the wave theory was by no means clear, nor is it thoroughly clear even at the present day. Nevertheless, the wave theory, so far as it went, admirably fitted the facts, and incorporated the whole of optics in a systematic

and comprehensive way, so much so that it may almost be said that nothing of the first magnitude has been done in that subject since, always excepting the discovery and the applications of spectrum analysis—the analysis of light into its ingredients, as emitted each by a simply vibrating source.

During the next quarter of the century scientific progress lay chiefly in the department of heat and energy, and in the accumulation by Faraday of a mass of experimental materials ready for the organisation and systematisation of a later period. The works of Carnot and of Joule belong essentially to this epoch. The names of these two men are not so well known outside scientific circles as their genius and the importance of their discoveries warrant. Carnot died young, having laid the foundation for a comprehensive theory of all engines whose motive power is heat. Joule lived to old age, but worked quietly and secludedly in a suburb of Manchester, declining many of the scientific honours which would have been heaped upon him and which might have brought his name into more public notice, happy only in his work and in its full and enthusiastic recognition by the leading spirits of his time. Hence to the outer world his name is comparatively unfamiliar. The result of all his work and that of his contemporaries is the unification of physics under the great generalisation called the conservation of energy; and the far-reaching theory of Helmholtz, developed from that of Mayer, as to the gravitative source of solar radiation energy, was thereby rendered possible.

The third quarter of the century is dominated by the names of Kelvin and Maxwell and Helmholtz. In it our theoretical and practical knowledge of electricity and its properties were widely extended, and an intimate connection was perceived between electricity and light. A great mathematical theory of electricity was elaborated

akin to that of light in the early part of the century, not specifically dynamical (its dynamical basis, indeed, is not clear), but admirably fitting the facts and systematising them in a comprehensive manner. That, too, is the date of a theory of vortex motion, and an attempted hydrodynamical theory of matter and many of its properties, such as elasticity and the like. There can hardly be any need to bring into notice this suggestive hypothesis —that matter is composed of vortices in a perfect fluid— for it has in some form caught the attention of every educated person. It has not yet been worked out into a complete and satisfactory theory, but it is extremely probable that some form or modification or extension of this hypothesis will be found to correspond with the truth; and the portion of it which explains elasticity and rigidity as due solely to *motion*, on the principle of the gyrostat or top on the one hand, and of the stiffness caused in a flexible tube by water driven rapidly through it on the other, cannot but be regarded as effectively substantiated.

The last quarter of the century has been signalised by investigations connected with the ether of space, the direct production and detection of electric waves by Hertz, and the attempted unification of all material phenomena under one single dynamical conception (not dynamical exactly in the narrow sense, but essentially dynamical nevertheless, though of a generalised type), an ambitious attempt to grasp the whole of material and ethereal properties under one comprehensive scheme or formula. These matters are too recent, and in many respects too unfinished, for appropriate enlargement here.

Thus the mark of the century has been a continuous attempt at a comprehensive understanding of nature, after the manner of Newton, but not limited or governed solely by his dynamical ideas. Throughout the century there have been those who have insisted on a rigid appli-

cation of the old dynamical laws; and of these the chief has been Lord Kelvin. His influence on science, putting aside for the moment his many discoveries and inventions, has been a steadying one, constantly recalling physicists from flights of fancy to the rigorous fetters of Newtonian dynamics. His influence in this way has been of the utmost benefit; it has kept physics in a severe and strenuous condition, and it may be said that all that was dynamically possible in the narrow sense under these conditions has been done. But the question arises, and has constantly arisen, whether, after all, the complete explanation of the material universe *can* be made in terms of ordinary Newtonian dynamics. That Lord Kelvin has not succeeded to his own satisfaction in giving such a complete account, such a complete formulation of material existence, in spite of his extraordinary powers and preparedness, may be due to the fact that no complete formulation on these lines is possible. The properties of matter assumed by Newton, and made the basis of his *Laws of Motion*, may themselves require and be susceptible of explanation, though not of explanation in their own terms. The really fundamental dynamics, we are now beginning to see, must have an ethereal and not a material basis — must be something more general than what has hitherto been called dynamics, and must include it as a special case. The whole meaning of such fundamental concepts as motion, and matter, and inertia may have to be examined, analysed, and explained. The laws of electricity may have to explain not magnetism only nor light only, but matter itself; and the most fundamental property of matter, its inertia, may be susceptible of electric or ethereal explanation. The Newtonian laws of dynamics as applied to matter still hold, and will always hold, but they may no longer be fundamental or ultimate; they may be derivatives from a still deeper scheme, and it is towards this deeper scheme

that physicists at present are groping. The realisation of a need for some such scheme constituted the chief philosophic feature of the latter part of the century.

The great biological doctrine of evolution has not had very much influence on physics. An attempt has indeed been made to trace conjecturally the evolution of matter from some simple primordial substance: the different kinds of atom being supposed to crystallise out at different stages in the past history of the world. But even if an interesting speculation like this turns out as in any way corresponding with facts, it would be a process very different from that contemplated by the doctrine of the evolution of living things by inheritance and survival: an evolution of material atoms would be a mere inorganic crystallisation, for the essential features of struggle, and death, and survival, and hereditary descent would be entirely absent from it; indeed, the whole subject of life is at present alien from any scheme of physics which has so far been formulated.

It may be said that we dimly see our way to a comprehensive unification of the material universe so far as it exists without the inclusion of life and mind. The unification is not complete, but it is in process of being completed, and though a vast amount in this department undoubtedly remains to be discovered, it is unlikely that any essentially new departure on totally unsuspected lines will be needed for its accomplishment. But when we come to the inclusion of life and mind, the prospect is quite otherwise. We have not at present even an inkling of how these things are to be included in the scheme of physics; the alphabet of their theory is not yet composed; they exist as empirical though undeniable facts. If it happen that during the twentieth century their real meaning is grasped and formulated, it will not be by reason of any legacy left by the orthodox science of the nineteenth, but it will be a new development, of whose

features only a few persons here and there, barely inside the pale of science, have at present any dim and rudimentary conception; and inasmuch as the laws of ordinary dynamics have shown themselves apparently incompetent to deal fully with the phenomena of light and electricity, so much the more is it unlikely that these laws will have any satisfying or comprehensive application in the regions of life and of mind. Nevertheless, the attempt to include life in a more general scheme of physical science is one that should be strenuously made, and in the long run it may conceivably turn out successful. We may find that a sufficiently complex molecule takes on of itself the functions of protoplasm, that a suitable accretion of protoplasm becomes a living cell, while an aggregate of cells constitutes a living organism. This undoubtedly represents the hope of biologists, and it is not an impossible one, nor one with which a physicist has any wish to quarrel. Indeed, many, though not all, physicists would agree to this, and would gladly join in the quest for a physical or material basis of life.

And "mind," too. There are some who would extend the same hopes and aspirations to mental phenomena also, and would hold that a mechanical formulation of the universe must, when complete, include thought and consciousness also, as the outcome of the constitution of matter and the interaction of atoms. About the middle of the century this tendency or this hope was strongly manifest; it gave rise to enthusiastic *Eurekas* sounded long before their due time; the wish ran in advance of the facts, and prophecy, as in Tyndall's Belfast address, took the place of sober statement.

Permitting ourselves a similar latitude now, we may say that at the close of the century the tendency above noted is not so marked. It is, indeed, hidden, and may be thought non-existent, but it is still there and in a refined or inverted form. Those who hold it as a

view, or a hope, no longer seek to reduce mind and life to a material level; rather they seek to elevate matter and all existence to the level of mind and spirit, that God may be all in all. Undoubtedly, the philosophic attitude of the leading physicists at the close of the century is devout; the outlook appears to them no barren wilderness of materialistic atheism, but a land of promise, energised and suffused by a divinely immanent and all-inclusive spirit.

It is remarkable how such a conclusion can be held in view of all the facts now known; yet so it is. In the face of discoveries which time after time have seemed overwhelming, the old faith — the faith common to all humanity in its various grades—is still dominant; a link between the lowest savage and the highest sage. It is astonishing that so it should be. Epoch after epoch of scientific discovery has arrived, each having the apparent tendency to do what has been paradoxically called "eject the Creator from His world," by showing that the universe was able to run automatically and without guidance or interference, or even initial start; that it contained within itself all the elements of permanence, like a self-winding and unwearying clock. The final blow to the ancient doctrine, that the earth was a tended garden with all else subordinate to it, was dealt by the Copernican demonstration, enforced by Galileo, that it was only one, and a small one, among the myriads of other worlds. The Newtonian theory of astronomy, displaying the simple mechanism whereby all the motions and interactions of all these bodies went on in a perfectly predictable and automatic manner, without guidance or propulsion, though it never seems to have excited the conspicuous ire of theologians, was nevertheless well calculated to do so; and if its immediate consequences had been grasped, it ought, one would think, to have met with opposition. It was a camel compared with the Copernican gnat.

Then gradually came an insistence on an extended form of the Cartesian theory of the mechanical or automatic nature of life: the doctrine that living processes are likewise governed by the ordinary laws of physics and chemistry; that though they are peculiarly complex and difficult to follow in detail, they are nevertheless of the same intimate nature as the working of inorganic atomic machinery, and involve nothing essentially new. This is even now not a known fact, but a dogma — a dogma held with various degrees of tenacity and not yet made an article of scientific faith. But the discoveries of geology stand in a different category; these show undoubtedly that the earth has existed millions of years longer than had been supposed; that its surface has been subjected to extraordinary changes; that animal and plant life has never been lacking from extremely remote periods, and has gradually by exceedingly slow steps improved in quality, showing no sign of having sprung full-fledged into existence by creative fiat.

The consevation or constancy of energy; the doctrine that no new energy ever makes its appearance; the discovery that, on the other hand, heat is not constant, but can be manufactured *de novo* by the clash of matter; the corresponding explanation of suns and solar systems by the condensation of nebulæ (originally an unsubstantiated inspiration of Kant); the more recent discoveries that a mass of matter, simply by being large enough, thereby possesses an atmosphere, becoming a possible habitable planet; and that another mass by being very much larger may, solely for that reason, be white-hot and therefore become a sun, capable of affording the conditions necessary for the maintenance of life on planets revolving around it—these facts all tend in the same antitheological direction and conspicuously have led students along that path. And then, finally, the view that inheritance and survival, without guidance or control, were adequate

satisfactorily to explain all the forms and adaptations of animal and vegetable life, whenever there was contest enough to stimulate activity and to destroy the feeble and unfit — this doctrine was, and is to this day, held by many to complete the demonstration of purely automatic working, and to leave no room for any but mechanical and material guidance or " cause."

Yet, in spite of all this tendency, the actual result has been different from what was expected. The outlook does not correspond with what was, by some hopefully, by others dreadingly, anticipated. The unspoken thoughts of the leaders of science, acquainted with all these discoveries, have become not less but more essentially religious, employing the term in a broad sense without reference to churches or sects. They realise that all this may be true, but that much else may be true, too; they perceive that all our boasted progress is, after all, only a beginning; that we are still, as it were, in the dawn of human intelligence; that the human mind is only beginning to realise its power of exploring, and, in a blind way, of understanding the secrets of nature, and that it would be indeed a narrow and superficial and purblind view to take if, in the enthusiasm generated by a few material conquests, the deeper feelings and instincts and emotions of the human spirit were thwarted and crushed. It is felt that, after all, what we are really and primarily conscious of is not matter, nor force, nor energy, nor any kind of outside occurrence: all these are inferences; that which we inevitably and directly feel is " ourselves," our own intelligent and perceiving consciousness. And just as it is in terms of this subjective central reality that all else must be stated and comprehended, so it may objectively be with the cosmos; its essence and core may be no external phenomenon, such as serves to appeal to our organs of sense, but an all-embracing, penetrating, and inspiring Thought.

PSYCHICAL RESEARCH OF THE CENTURY

By Andrew Lang

IT is difficult even to give a name to the subject of this essay. The word "psychical" seems to beg the question and to insinuate that there is such a thing as a *psyche*, or soul, distinguished from the ordinary intellect. As a matter of fact, psychical research is only an inquiry as to whether there be any faculties and phenomena, to which, for lack of a better name, the term "psychical" may be applied. That there are such faculties and such phenomena, has been the belief of the majority of mankind in all known ages. A singular uniformity marks the beliefs (or superstitions) of all periods, races, and conditions of culture. This uniformity, of course, does not, as Dr. Johnson inferred, amount to proof. Curiosity and love of excitement, wearied with the "natural" (that is, accustomed) round of events, had only to imagine exceptions to everything normal, and "miracles" of uniform character were at once asserted. A dead man does not walk about: deny this — and ghosts walk. People cannot be in two places at once: deny this — and you have "bilocation." Men do not fly: deny this — and you have "levitation." The future and the remote are dark to all: deny this — and you invent every branch of prophecy, seership, and clairvoyance. Inanimate objects are never spontaneously volatile: affirm the opposite — and you are confronted with the "physical phenomena" of "Spiritualism." Fire always burns objects subjected to its action: affirm the opposite — and you come to

Shadrach, Meshach, and Abednego. Thus the uniformity of the beliefs in such marvels is very readily explained.

But the explanation becomes more difficult when you have to deal, not with savage mythology and civilised folklore, but with the attested experiences of educated modern men and women. They have witnessed one or other of these marvels, or so they persist in averring. Their experience has been identical with that of savages and barbarians; with that of classical antiquity; with that of saints, witches, and members of the Royal Society at the time of the Restoration. This fact is so puzzling that, at different periods, educated persons have investigated the evidence for the reported marvels. In the Alexandria of the fourth Christian century, Porphyry; in the England of Charles II., Glanvil, More, Baxter, and Boyle; in the America of 1680–1720, the Mathers; in the Germany of 1760–1830, Kant and Hegel; in the France of 1780–1830, various learned bodies, took part in these investigations. Little that can be relied on was discovered. The researches were usually unmethodical, often prejudiced, often superstitious. Only in the last twenty years has inquiry been methodical, sceptical, and persistent. The practices of Mesmer at the end of the eighteenth century opened the way. They interested, in the nineteenth century, the Schellings, Hegel, and Ritter. Hegel believed in clairvoyance, in what is called telepathy (the action of distant mind on distant mind, through no known channel of sense), and in the divining-rod. For all these things he found a place in his *Philosophy of Spirit*. The theory which explains what we call facts of hypnotism by "animal magnetism" was accepted, or at least many of the marvels of this kind were accepted, in a report of a scientific French committee in 1831. But the report was burked, and the topic was banished to keep company with the origin of language and the squaring

of the circle. Yet the topic kept recurring, and the "magnetic sleep" was vouched for by Dr. Elliotson. About 1841–45, Braid of Manchester introduced the word "hypnotism," to cover the phenomena of induced somnambulism. He proved that the old theory of a magnetic efflux from the operator was superfluous, and that the sleep, with all its peculiarities of hallucination, and of submission to the will, could be induced in a variety of mechanical ways. The patient could be made insensible to pain, and only the introduction of chloroform checked the use of hypnotism in surgical operations. It was also shown that the mind of the hypnotic patient could be so influenced to affect his body, and, at least in nervous and hysterical diseases, to exercise a healing influence. These discoveries, obviously, explain many of the stories of witchcraft, of healing miracles, and of "glamour," or the induced false perceptions, which were part of the stock in trade of conjurers in the Middle Ages and the seventeenth century.

So far, I think, these inquiries have undeniably reached solid ground, and have cleared up the obscure subject of witchcraft. The only question is one of degree. How far are the stranger phenomena of hypnotism, such as the suggestion of sleep from a distance, based on good evidence? In the middle of the century, Drs. Gregory and Mayo, in two interesting works, investigated the amount of truth involved in popular superstitions. They accepted clairvoyance and successful crystal-gazing, that world-wide practice. Meanwhile, many physicians and others worked at the topic of hallucinations of the senses, both in the sane and the insane. A few of them brought forward cases of premonitory dreams and telepathic incidents, which they professed to be unable to explain away. The subjects of a certain Major Buckley (1840–50) were deemed to be peculiarly clairvoyant, and the anecdotes, in one or two cases, have good evidence. The case of

"Queen Mary's Jewels" (criticised in my *Book of Dreams and Ghosts*) has, at all events, romantic historical interest. In 1848, a very old set of beliefs was moved into new life. The noises and disturbances in the family of the Foxes at Hydesville were only a link in an historic chain of similar alleged occurrences. They are of rather more than dubious authenticity, but they were the beginning of modern "Spiritualism," with numberless impostures. The chief thaumaturge and prophet of the movement was Daniel Dunglas Home (his palmy years were 1855–65), who had a singular career of social and magical successes in the courts and literary society of Europe. Few feats of savage, or Neoplatonic, or saintly wonder-workers were absent from his *répertoire*, and living men of the highest eminence in physcial science are still wholly unable to explain what they saw of his performances. I have known but one case in which, on first-hand evidence, imposture was attributed to him; and a jury practically found him guilty of cajoling a silly old woman out of her money. That is the blot on Home's scutcheon; for the rest, the great mass of unpublished letters to him from many distinguished correspondents attest his inexplicable success. He was not a clever man, and, had he not been a "medium," would have been a reciter and musician of the drawing-room. Other "mediums" on the same lines have been numerous; few, if any, professionals have escaped exposure. Meanwhile, the theory of the feats, that they are caused by "spirits," is now almost confined to the half-educated.

Much, at this time, was written about "table-turning." This is a form of automatism familiar to most savage races. A person, or persons, touches a table, a stick, a pencil, or what not; the thing moves, under no *conscious* muscular action of theirs, and gives responses to questions by its movements, in a variety of ways. These responses are sometimes correct, though unknown to the

operators. Dr. Carpenter explained these things by a theory of "unconscious cerebration." Everyone will admit that many things are registered in the mind of which the ordinary consciousness is not aware. Many things once present to consciousness are forgotten. Again, a person speaks to you when your mind is engaged. You know nothing, consciously, of what has been said, yet it is registered in the brain. The theory, then, is that the "unconscious," or "subliminal," or "subconscious" self expresses its knowledge through unconsciously exerted muscular movements. But the phenomena were often ascribed to the action of "spirits." The philosophy of the unconscious, or subconscious, studied by Kant and brought to England by Sir William Hamilton, had not attracted attention in England. Psychical research, investigating automatic actions, has enlarged our knowledge of this obscure topic.

Another theme is that of diabolical or spiritual "possession," the patient assuming a new character, speaking in a new voice, and discoursing about facts of which, normally, he is ignorant. Returning to his normal self, he is unaware of what he did in his secondary self. The new name for what was called "possession" is "alternating personality," a condition which seems akin to the difference between the sleep-walking or hypnotised and the normal, waking self. How such secondary selves acquire their apparently supernormal knowledge, whether by revival of knowledge unconsciously present even in the normal state, or otherwise, is an unsettled question.

After the "spiritualistic" wave had expended itself, at least among the educated, a society was formed in England, "The Society for Psychical Research," to investigate the whole mass of reported supernormal phenomena. The founders, about 1880, were a group of Cambridge scholars, the late Mr. Edmund Gurney, Mr. Frederick and Mr. Arthur Myers, the late Professor

Sidgwick, Mr. Podmore, and others. Many men of science, such as Sir William Crookes, Prof. Balfour Stewart, Prof. Oliver Lodge, the late distinguished electrician, Professor Hertz, with Lord Tennyson, Mr. A. J. Balfour, M.P., Mr. Gladstone, and a number of British and Continental savants, lent their names and a portion of their energy to the Society. In the American branch, Prof. William James, with others, represents official psychology. The object of the Society was to collect and cross-examine first-hand evidence for the ancient alleged phenomena called "ghosts," "wraiths," "haunted houses," clairvoyance, premonitions, "spiritualistic disturbances," and so forth. The Society thought that ideas of such old standing and wide diffusion, and reported modern experiences in the same kind, ought to be scientifically examined. Experiments were also to be made. The leaders were men familiar with the science of psychology and of the brain. Mr. Myers and Mr. Gurney especially conducted a long and careful series of experiments in hypnotism. Mr. Gurney published a very learned essay on *Hallucinations of the Senses*. Meanwhile, Mr. Gurney especially, with Mr. Myers, Mr. Podmore, and Mr. and Mrs. Sidgwick, collected all available first-hand evidence for "ghosts" of the dead and "wraiths" of the living or dying. The personal examination of witnesses and of corroborative evidence was pursued with minute and conscientious care.

Moreover, many experiments were made in "thought-transference." One person, say, thinks of a diagram, a picture, a card, or what not, which another person, carefully excluded from sensible contact with the first, endeavours to reproduce. The results often seemed highly successful, and experience enabled the experimenters to discover and eliminate such causes as "unconscious whispering," as well as to detect some methods of fraud. Having convinced themselves that the transference of

thought, not by any recognised channels of the senses, was a possibility, even when the experimenters were not in the same room, the investigators applied their discovery to their great collection of ghosts and wraiths. The results were published in two large volumes, called *Phantasms of the Living*. The argument, put briefly, was that the mind or brain of a person in a crisis, notably in the crisis of death, could affect by visual, audible, or other hallucinations of various kinds and degrees, the mind or brain of another person at a distance. This was a mere development of the idea of voluntary and experimental thought-transference by no recognised channel of sense. These conclusions, if accepted, account for the universal belief in death-wraiths. But, of course, an obvious difficulty arises. Many sane and temperate people have had experience of the hallucination that a distant person is present, when that person turns out to have been in perfect health and in no crisis at all. Therefore we must ask, do the hallucinations which coincide with a death or other crisis coincide by mere accident, and so afford no evidence for the action of mind on distant mind? Without an enormous census, this question cannot be decided. The Society, however, collected more than seventeen thousand answers to a list of questions, and the committee satisfied themselves that, on this body of testimony, the hallucinatory appearances coincided with the death of the person who seemed to appear four hundred and forty times more often than ought to be the case by the law of probabilities. They pronounced that "between deaths and apparitions of the dying a connection exists which is not due to chance alone." This position has been attacked by Dr. Parish in his *Hallucinations and Illusions*.

The Society, as a society, expresses no opinion, but the committee of the Society, for their part, decided that wraiths are coincidental, or veridical hallucina-

tions, produced by some unknown mental or cerebral process, called, provisionally, " telepathy " — sensation from a distance. Whether the process is physical, and caused by the molecular action of one brain upon another distant and recipient brain (as in " wireless telegraphy "), or whether the process is psychical, and involves the action of a mysterious psychical faculty, there is no means of deciding. But if we admit that there are phantasms of the dead, not being mere casual hallucinations, then we must conceive the process to be psychical: the *brain* of the dead being dust, the " soul " must be the agent. Of phantasms of the dead, or " ghosts," the Society has collected numerous examples at first hand. On the hypothesis already explained, these appearances would be caused by the action of the disincarnate upon the living mind. But how can it be proved that the phantasm is no mere empty hallucination or illusion, begotten subjectively by grief, by association of ideas, or by a casual arrangement of light and shade ? We have, in the case of the dead, no coincidental crisis of their own to which to appeal, as in the case of phantasms of the living. The only possible test is the communication by the phantasm of knowledge otherwise unattainable by the percipient.

The modern ghost seldom speaks, and the knowledge is indirectly communicated. One or two examples are needed. Thus, residing in a house in Switzerland, a lady saw a phantasm exactly like the portraits of Voltaire. She then learned, for the first time, that she occupied what had been Voltaire's room. But had she not known about Voltaire's connection with the house, and forgotten ? Again, a young American, when making up his books in an hotel, sees the phantasm of his dead sister, with a long scratch on her cheek. His mother tells him, what she had kept secret, that she herself accidentally scratched the cheek of the corpse as she arranged flowers

in the coffin, and that she concealed it by aid of powder. But, granting telepathy, was not the phantasm a projection from the mind of the mother, who knew the fact? It is plain that telepathy, if accepted, makes it almost impossible for a ghost to prove his identity. He can do this only by communicating knowledge contained in no incarnate mind, but afterwards discovered to exist in some long-lost document or other source of evidence. The nearest approach known to me to such a thing is in the case of Queen Mary's secret jewels. Gregory published a "vision" of these jewels, with many attendant circumstances, beheld by a hypnotised young man. Several years later was discovered, in a heap of old law papers in the Scottish Register House, an inventory of Queen Mary's jewels. Still later the inventory was published by Dr. Joseph Robertson. I compared the inventory with the account of the vision, and the results were, to a considerable degree, corroborative. But corroboration of this kind must, in the nature of the case, be very rare.

Thus any knowledge contributed by a seeming phantasm of the dead may be explained away by a sweeping theory of telepathy. The phantasm makes you aware of this or that fact, which is verified. But if the verifying evidence may conceivably have become known, say to a German savant working in the Sultan's library, then it may be urged that the German savant unconsciously "wired on" his information to you in the shape of an hallucination. This theory is not easily accepted, but it may be more credible than the hypothesis of an hallucination caused by a disincarnate mind.

As to "haunted houses," the Society has occupied many to little purpose. Ghosts, indeed, are seen, and astonishing noises are heard by such members of the investigating parties as are in the way of experiencing hallucinations wherever they go. But that proves nothing. I myself stayed for a week in a "haunted house," whence

the noises had evicted a large shooting party, but nothing beyond the normal swam into my ken. To be sure, I had asked for as quiet a room as possible — I certainly got it. As far as the researches of the Society go, the ghosts retreat before them, whereas, on the theory that the Society are superstitious fools, they ought to see ghosts in exceeding abundance, by dint of expectation. It would appear that haunted houses are local centres of a permanent possibility of hallucination. Thus in an old house at St. Andrew's, a cheerful family last year constantly met an unknown lady on the stairs. She always went into the same room, but never was found there when pursued. The cheerful family regarded her as a pleasing peculiarity of the mansion. This anecdote leads to the difficult topic of "collective hallucination," as when a number of persons similarly situated are similarly and simultaneously hallucinated. The causes remain a puzzle. Are all affected by an external cause, or does one person "wire on" his hallucinations to the others?

It will be observed that this theory of hallucination gets rid of the old puzzle, "How about the clothes of the ghost?" Clothes have no ghosts, yet I have heard of only one ghost without clothes (on the evidence of the report of a criminal trial in 1753). The new theory simply explains that there is neither ghost nor clothes in the case; the hallucination merely includes clothes for the sake of decency, or because the agent, the mind which affects the percipient's mind, thinks of himself as dressed, "in his habit as he lived."

While the Society, advancing from the experimental thought-transference to telepathy, has more or less explained "wraiths," and has, perhaps, suggested a conceivable theory of ghosts, in the region of spiritualistic material phenomena, as of volatile articles of furniture, it has found no certainty. Experiments with paid "mediums" have invariably resulted in the detection of imposture,

notably in the case of Slade and of Eusapia Paladino. But it is fair to say that some thinkers even now believe that Eusapia occasionally gets her effects without cheating. In the cases of amateur mediums, many things told on evidence unimpeachable in worldly matters are certainly hard to explain. For a number of years a Mrs. Piper, a *citoyenne* of the United States, has been closely studied by the learned, as by Prof. William James, Dr. Hodgson, and Prof. Oliver Lodge. Her specialty is to convey, by writing or word of mouth, " messages from the dead." Vast reports on Mrs. Piper have been edited by Dr. Hodgson, certainly a clear-headed and sceptical observer, who exposed Eusapia Paladino and Madame Blavatsky. As at present advised, Dr. Hodgson expresses his belief that the dead do communicate through Mrs. Piper. Others hold that the "communicators" are only " secondary personalities " of the lady, and that, when she does hit on facts not normally knowable by her, she owes the information to telepathy. How is the reverse to be proved ? How can she communicate matter at once capable of verification, and yet unknown to any living mind ? This is the old difficulty which besets spirits of the dead.

On the whole, psychical research has, I think, shown that there is a real element of obscure mental faculty involved in the " superstitions " of the past and present. It has also made some discoveries of practical value in hypnotism and the treatment of hysteria. It strengthens the opinion that science has not yet exhausted all attainable knowledge about the constitution of man. The study has usually been criticised by persons, as supercilious as superficial, who have not taken the trouble to get up their case, and who declaim against " the supernatural." There cannot be anything supernatural ; there may be many things supernormal. To the popular mind, to " the man in the street," psychical

research is interesting only so far as the man in the street thinks that it affords matter confirming, or confuting, the belief in the continued conscious existence of the human personality after death; or as supplying "tips" for the turf or the Bourse. Science is not concerned with these practical results, but only with the investigation of phenomena.

EVOLUTION AND RELIGIOUS CONCEPTIONS

By Leslie Stephen

THE future historian of thought will no doubt regard the promulgation and the rapid triumph of evolutionist doctrines as the most remarkable phenomenon in the intellectual development of the nineteenth century. At present it would be presumptuous in anyone to attempt any adequate estimate of the bearing of those doctrines upon religious conceptions. I can only venture to indicate some of the obvious considerations which occur to a contemporary. Perhaps the most obvious is that some theory of evolution must be the natural goal of all coherent philosophy. To reason is to unify our knowledge, and therefore to detect continuity in the whole world-history ; to show how to-day follows from yesterday, and therefore from an indefinite series of yesterdays.

Our ancestors thought it necessary to stop somewhere. The traditional cosmogonies trace history back to an absolute beginning. The drama begins, as it will end, with a catastrophe. Bossuet could base a history of mankind upon the assumption that the Hebrew legend represented indisputable historic truth. By the beginning of the nineteenth century the progress of rationalism had made such a position impossible. After Voltaire it was impossible to take the historical truth of the Bible narratives as a postulate needing no further proof. The eighteenth-century rationalism, however, had been content to deny without caring to explain the beliefs. It accepted, we may say, the orthodox assumption that religions had

been originated by professed revelations. It differed by declaring that the revelations were in fact false, and inferring that the founders of religions were deceivers. Religion was based upon imposture and supported by the devices of priestcraft in alliance with tyranny. The enthusiasm for the reign of reason took, therefore, the form of demanding a complete breach with the past. Churches, like political institutions, were to be simply abolished, and the creeds upon which they reposed were to be disproved as simply false. A religion, then, was not so much a stage in the evolution of thought as an excrescence which obscured the light of reason.

The modified rationalism of Protestants took up the challenge. The traditions, they granted, needed proof; but proof could be supplied. The "evidence" writers tried to prove the authenticity of the impugned documents. Supernatural revelation can be proved only by supernatural events, and the whole case was staked upon the occurrence of miraculous interventions in remote centuries. The argument, therefore, still supposes a complete breach of continuity, and a similar breach was implied in the theory of natural religion. The deist had to be met as well as the sceptic. The believer in the necessity of a revelation was jealous of the claims of its rival. If a religion could be founded on pure reason, revelations would be superfluous. Natural religion itself must therefore be regarded as empirical; founded not upon demonstration, but upon observation of facts. The believer relied accordingly upon the argument from "design." That implies a deity who, as Pascal said of Descartes's Supreme Being, gave now and then a fillip to the universe, and afterwards became quiescent. The natural order upon this view proves the existence of God precisely so far as it supposes discontinuity. Things grow of themselves; but they must have been originally made by an interfering artificer. This implies the old "teleology,"

which was to find itself in conflict with Darwinism. The truth of all theology was based essentially upon intervention. The existence of a deity is inferred not from the regularity of the laws of nature, but from the gaps which occur in the regular order. The truth of a revelation is inferred not from its conformity to the voice of reason, but from the manifestations of a supernatural power which prove the right of the prophet to teach doctrines inaccessible to reason.

The suicidal nature of this position was perceived by the leaders of the Catholic reaction which followed the revolutionary movement. The Protestant, they said, was in an impossible position. He disbelieved the modern, and accepted the ancient, miracles. A natural theology which appeals to the physical sciences and yet relies upon catastrophes is in an equally false position. As science ranges more and more phenomena, once taken to be abnormal, in the series of natural events, it saps the evidence upon which reliance has been placed. To accept scientific proof and yet to deny the "uniformity of nature" is hopeless. The Catholic so far agreed with the sceptics; but he met scepticism by making the supernatural a part of the normal order of history. The Church is a living society, possessing divine authority and basing its claims upon a continuous manifestation of divine characteristics. So far, the principle of continuity is admitted, and we have in consequence a view which, as Newman's essay upon *Development* showed, might approximate to a doctrine of evolution. The divine action is at least not regarded as something accidental, essentially arbitrary, and now inactive. It supposes an authority always present; an ever-present factor in the process of human history, and entitled to override the criticisms of secular science.

The difficulty recurs in another shape. Unity is lost if continuity is preserved. The Church and the world,

faith and science, are two disparate powers in continuous conflict. It may be more consistent to claim supernatural authority for a permanent society than to limit the claim to individuals who lived many centuries ago. But the closer the authority is to us, the more it is exposed to criticism; and the more difficult, to opponents at least, to recognise its supernatural character and its right to override the teachings of reason. In any case, too, the creed involves an historical element. The Church has only existed within definite limits of time and space; and you can only make it a key to universal history by neglecting the great majority of the men and the indefinite ages which preceded the revelation. To the philosopher, therefore, the error seemed to lie deeper. Religion, he held, must be disengaged from any purely historical element; it cannot depend upon a knowledge of special and local facts; it is not a simple addition to our knowledge, but appeals to the faculties which belong to man as man, and to the race in all times and places.

To the religious mystic or the transcendental philosopher, therefore, it was impossible to admit the claim of any historical religion to be unique and absolutely true. But, on the other hand, every religion must be a partial recognition of universal truths. An inner light shines in all men, refracted or distorted by local accidents. We must, then, recognise the value of the historical creeds. The mere matters of fact which they allege may be figments; and the deities, whose influence they assert, mere phantoms of the imagination. It does not follow that the religions are simply false; however imperfect, they are symbolic or approximative, glimpses of the truth seen through a distorting haze, by torpid and ignorant minds. To state this fully is to accept some theory of evolution.

The tendency was represented most emphatically by the German philosophers, who worked out elaborate

schemes, showing that the history of the world was in some sense a continuous process of reason, or "dialectic." Their attempt to cast aside the empirical element altogether, to construct a philosophy independent of anything but pure logic, led to doctrines describable by the man of science as "transcendental moonshine," cobwebs of the brain and idle logomachy, which could give us no real, substantial ground for a definite creed. Yet they emphasised the necessity of recognising the unity and continuity of all human history, and considering every form of being as corresponding to some movement of a great evolution. Liberal theologians, sympathising with this view, endeavoured to "spiritualise," or rationalise, the old dogmas; to interpret them as partial views of the truth, or to cast them aside as accidental and local accretions. The tendency to regard the dogmatic system as mere husks or envelopes of higher truths became characteristic of the period.

Meanwhile, great changes were taking place outside of such philosophical speculation. The unprecedented growth of the physical sciences was discrediting belief in the supernatural. And yet, in some directions, conflict between faith and science was not so marked as it afterwards became. The difficulty about reconciling geology to the first chapter of Genesis was a point of detail. Sciences which deal with inorganic matter do not raise questions of growth or evolution; and Faraday could be at once a "Sandemanian" and a great discoverer in his own department. In the meantime, however, the practical applications of science were revolutionising the industrial and social relations. Great spiritual movements take place when the intellectual horizon has been suddenly widened; when separate races have been brought into closer contact by conquest or commerce; and when local beliefs have been destroyed, or absorbed into more cosmopolitan creeds. Toleration and indifference to

dogmas had grown, as nations had been brought together, and it had become impossible to believe that the differences between Protestants and Catholics would justify the damnation of either. The process was now extending with unprecedented rapidity and had many applications. The wider knowledge of the great religions, for example, made it impossible to explain them by the simple hypothesis of the supremacy of the devil in the Eastern world. History in general develops as civilised man becomes more and more of a record-preserving animal. The old chronicles had been succeeded by wide surveys, such as Gibbon's great panorama, bridging the gulf between ancient and modern history. Men learned to be interested in their ancestors; and the fact that even in the " dark ages " men had really lived and thought and felt was recognised by the " romantic " movement. The convulsions due to the revolutionary attempts to break off all connection with the past brought home to all men the conviction that, for good or for evil, all human institutions are deeply rooted in tradition and the ancient order. The attempt to understand history as a whole involved the necessity of looking below the mere surface of events. History appears to be discontinuous so long as all events are attributed to individuals, and therefore supposed to depend upon accident. Historians began to dwell upon the underlying processes of which kings and conquerors are the more or less unconscious instruments. The necessity for a more rigid examination of evidence, gradually recognised by the great historians, was stimulated by the analogy of the physical sciences. By the middle of the century the extension of critical methods to documents once recognised as sacred was beginning to startle the placid believers in old traditions.

These are a few corollaries from the great change which affected every department of thought. It meant

that some doctrine of evolution was more or less demanded in all speculation; or, as one may say, that the doctrine itself was not a sudden catastrophe, but evolved by natural processes. Science, in all cases, tries to find the simplest formula from which all the ascertained laws of nature can be deduced. Give the astronomer his atoms and his gravitation, and he can work out his whole theory. But as science extends to the problems of organic life the problem is indefinitely complicated and necessarily becomes historical. We have to do with the most varying actions and reactions; with objects constantly changing and growing and not reducible to different combinations of constant atoms. We must still regard all change as continuous, and therefore exclude catastrophes and interventions. Explanations must be sought by studying the simplest or most embryonic forms, and investigating the processes through which they have developed into the more complex. The historic or "genetic" point of view is therefore essential to successful inquiry. The vast importance of this method was making itself felt in every branch of inquiry from biology to psychology and "sociology." Its application by Darwin to one set of problems was of such importance because the need of similar methods was so widely felt throughout a vast range of other inquiries. His theory supplied the nucleus round which a number of hitherto vague doctrines might crystallise and take definite form and purpose.

This implies what I take to be a main characteristic of Darwinism. It marks the point at which theories of evolution become definitely scientific, instead of being merely metaphysical or transcendental. Philosophers, I have said, were naturally evolutionists in some sense. They were bound to hold the unity of the world. The doctrines of Spinoza or Kant or Hegel were as alien as Darwinism to doctrines of catastrophe. But metaphysical

doctrines were so far apart from the world of actual experience that they seemed to have no bearing upon it and to be capable of reconciliation with no set of facts whatever. The philosopher may hold that the world is somehow woven out of the categories of pure reason; but it is impossible to make any bridge between the world in which such processes take place and the world contemplated by men of science. Darwin's evolution, on the other hand, is throughout a theory of actual experience. He deals essentially with the verifiable and observable. Darwin notes that the carrier and the fantail are developed from the rock pigeon, and, by generalising from every-day facts, proposes to show how men may be developed from monkeys, or ultimately, perhaps, from protoplasm. His argument is based upon experience instead of abstract logic, and remains throughout in direct contact with experience. A conception which might be harmless, if not meaningless, when confined to the vague region of ontology, was now brought to bear upon plain facts, and upon the most familiar beliefs and conceptions. Darwinism was not only irreconcilable with the theory of "special creation," but was proposing to substitute an intelligible history. That, again, meant that science was making a vast extension of its claims. It was proposing to annex new provinces, if not to assert supremacy over the whole empire of thought. It had by slow degrees established a firm lodgment in the physical sciences, and was now to invade the ground hitherto supposed to be the separate domain of the divine or the metaphysician.

Some consequences were palpable to every one. The old cosmogonies with their catastrophes were incredible. They were, indeed, already discredited. It is now strange to find that forty years ago men could defend the legends of Eden and the deluge. The essence of such narratives was that, as miraculous, they required at

least exceptional evidence, and yet, as referring to the origins of history, excluded the very possibility of any support by evidence. Evolutionism was hardly needed to slay the slain, though it made the growth of the old legends more intelligible as themselves examples of early stages of thought. The controversy between the defenders of faith and of science already implied a concession. The legends could only be defended in words by being explained away in reality. To argue that they might be so interpreted as not to contradict science was really to admit that science must be the ultimate arbiter. With the legends, the dogmas based upon legendary revelations must naturally fade. But that, too, falls in with previous tendencies. The old dogmatism was long ago effete, and no serious thinker could take any but an historical interest in the controversies between Athanasians and Arians, or between Calvinists and Arminians. Verbally, indeed, the dogmas may be even more easily accepted than of old, precisely because they have become verbal. They represent — not truths to be proved, but — symbols to be cherished.

Modern controversialists do not support new dogmas by direct argument, but invite us to accept them as harmless because really meaningless corollaries. The really effective appeal is to the moral, perhaps to the æsthetic, advantages of the whole system of belief; and, if sects are still bitterly opposed, it is because they represent different social or ethical types, not because there is any living interest in the doctrines ostensibly at issue. The whole basis of the argument is changed. Apologists do not try to force beliefs upon us by evidence of miracles, but by establishing the vital force of religion. This conspicuous tendency corresponds to a most important fact. It cannot be said that religions have become powerless. The churches still embody the strongest force in the world. The religious instinct, therefore, survives the

dogmatic system, and the true secret of its vitality is not in the ostensible logic once alleged in its defence. This, again, falls in with the conception of the evolutionist. The history of religion represents for him a vast problem in social dynamics. The less he believes in the truth of the allegations of the creeds, the more he has to consider the "utility" — in the widest sense of the word — of the religious sentiment. He asks, that is, what was the function really discharged by the religious organisms. The old deities may be mere phantoms, and the legend utterly baseless; what, then, was the source of their interest for mankind? The old argumentation over the famous diphthong may strike him as an absurd waste of metaphysical ingenuity; and yet he may perceive that questions were really at issue upon which the existence of the Christian Church depended. We have to consider the play of the imagination, not the logical fencing under which it was concealed. The religious creed, he may hold, represents the only mode in which ethical ideas could be set forth at the contemporary stage of thought. Though necessarily including erroneous hypotheses, it represented an approximation to sounder belief; and may have expressed in the only way then possible the highest conception then attainable of men's relations to each other and to the world in which they live. Philosophically, it may be crude; but it should properly be judged from the poetical or imaginative point of view. The ethical instincts were not the product, but the source of the legends. Achilles or Arthur may be purely fictitious, but the imagination which created them indicated, and in turn stimulated, the growth of heroic or chivalrous ideals.

And, in the next place, the great religions correspond to social organisation and to systematic moral discipline. They are intrinsic parts of the essential bonds by which all men are held together, and have marked out a system of the regulations of reciprocal relations. To judge,

therefore, of a religion simply by the truth or falsehood of its ostensible creed would be absurd. We may reject as unequivocally as we please the intellectual authority of the Catholic Church, and yet believe with Comte, for example, that its evolution was an essential factor in the diffusion of higher moral ideals and the growth of social institutions. So far, I apprehend, modern evolutionism falls in with the general tendency of thought. In seeking to explain the historical continuity of religious thought it must recognise the vital principle of religion. It coincides with the philosophic view, which, while rejecting old dogmatic systems as definitive statements of the truth, recognises their value as stages toward more tenable conceptions. It coincides with the Catholic view so far as it recognises the social importance of the churches, though denying their claims to supernatural authority. By asserting the continuity of social and intellectual history, it parts company with the old "negative" criticism which regarded creeds as simply false and churches as organised impostures.

But undoubtedly it raises further questions. When evolution took a scientific turn and appealed to experience, it came into sharp conflict with the old "teleology." Teleological language, indeed, may still survive and be held to give the natural outcome of a philosophy which holds the world to be an embodiment of reason. The divine element, indeed, must be conceived as "immanent," not external; to pervade the universe, not impinge upon it from without. "Purpose," however, is not only consistent with, but implies, order. The future and the past suppose each other. Assuming the past, the future must inevitably follow. Assuming the future, the past must have been so planned as to bring it about. One statement seems to use the language of arbitrary necessity, and the other of purpose or teleology. They are really correlative or only different modes of

contemplating the same truth. The scientific or Darwinian view cannot deny positively the existence of a plan, or prove the world to be "accidental," or irrational. But it implies an important modification. It appeals to experience, and therefore asserts that the plan, if there be a plan, can be known only by observation. The facts must be given, and we can then work backwards or forwards to the past or the future.

It binds us, then, to appeal simply to experience. We must accept its verdict impartially. We cannot apply the old "theodicées," or argue upon a-priori grounds that this is the "best of all possible worlds." We can know of no other world and appeal to no transcendental principle. We cannot argue from our own conceptions as to the proper course of proceeding for infinite wisdom and intelligence. Things, as a philosophic divine observed, are what they are; and it is idle to ask what they ought to be. Pessimists and optimists may argue as much as they please, but the only real criticism is the observation of the actual distribution of misery and happiness. This, indeed, seems to amount only to admitting the ancient truth that the "origin of evil" is an insoluble problem. It was already admitted to be hopeless; and we only admit more openly that it is really also meaningless. Our ultimate explanation could only be a systematic account of the actual order, and not a deduction of its order from abstract reason. We can abandon the old method with the less regret because it never achieved any plausible result.

Darwinism, indeed, alarms religious minds by what might appear to be its ultimate tendency. As scientific, and applying the methods of the physical sciences, it would lead straight to materialism. To trace the origin of organic beings back to the period at which no life existed is to imply that nothing except matter exists. We are nothing but a whirl of atoms, or mechanical automata,

and though we can be spectators of the world, the belief that we can react upon it is a mere illusion. To me, it seems that the problem remains where it was. It is as hard as ever thoroughly to carry out the materialist doctrine; and the supposed argument implies an illegitimate transference from scientific to "ontological" ground. The philosophers of coming generations may apply themselves to solve that problem. In any case, as I have tried to show, evolutionist theories mean, in the first place, a systematic application of the principle of continuity to every department of thought. Tacitly assumed in all reasoning about fact, it has come to be explicitly adopted as the horizon of thought has extended; and, in the next place, it implies the frank recognition of the necessity of basing all knowledge upon experience; of applying the methods which have created the physical sciences; and of accepting the coherent body of scientific knowledge as the nucleus round which all knowledge must crystallise into definite form. This involves the transformation of the old religious conceptions, and the rejection of the many traditional attempts which were at bottom totally inconsistent with an acceptance of the scientific principles. But, on the other hand, whatever metaphysical theory may be adopted, it involves the perception of the immense importance of the functions discharged by religion in the past. Their nature was wrongly conceived by the believers themselves. They took the supernatural for the foundation. They supposed the dogmas and the legends to be the whole principles, whereas they were incidental results of the great forces at play. Evolutionist doctrines can only lead us to understand more clearly what those forces were. Religion, it is often said, is an essential part of human nature. We may fully accept that doctrine in a certain sense. Men must always need some theory of the world, and of their position in it, as consonant as possible with the best established truths;

some mode of uttering the emotions and of setting forth the ethical ideals congenial to the theory; and a social organisation which may help to soften, purify, and elevate human relations. The evolutionist perceives the importance of making the framework of theory strong and sound,—such as may have nothing to dread from the most unequivocal acceptance of the results of scientific and historical inquiry. Therefore, however great may be the change, the evolutionist must recognise the true value of the religious instinct in its place, and admit the vast importance of finding a mode of embodying it in the future. How that is to be done is the great problem of the coming generations. The generation which is passing away has learned to perceive its importance; and the acceptance of evolution has modified the ancient creeds in many ways, which shows that men are becoming conscious of the necessary conditions of a satisfactory solution, however far they may still be from the solution itself.

APPLIED SCIENCE

PRINTING IN THE NINETEENTH CENTURY

By Theodore L. De Vinne

BOOKS printed in 1801 cannot be commended as better than those printed in 1501, for there had been no improvement in master printers and few changes in the old methods. The hand-press, said to have been improved by Blaeu of Amsterdam in 1601, was left by him about as slow as it was in the days of Aldus and Stephens. Its frame and platen were of wood, and its bed-rest for type was of stone. One pressman inked the type with a pair of leather balls, and was followed by another who pulled the bar four times to print on both sides a sheet seldom larger than 19 x 24 inches. By hard labour the press could be made to produce seven hundred small sheets (requiring twenty-eight hundred pulls of the bar) in ten hours, but the average performance was less.

Paper made by hand seldom exceeded the size 22 x 28 inches. Printers and readers had reason to complain of its coarseness, greyness, uneven thickness, and sophisticated manufacture. Types, not well graded as to size, and of few varieties but often of good design, were cast by hand at the rate of two or three hundred an hour. All work was by hand, but handwork did not imply excellence. When the workman was an expert, and loved his work, and had been provided with good materials, and was allowed time for its accomplishment, his workmanship was excellent; but these conditions seldom were combined. The typography of the ordinary book or newspaper of 1801 is not work to be proud of.

In 1794, Burke estimated the total number of readers in England at eighty thousand. This was not enough to justify expensive improvements in the mechanics of an art which had been persistently vexed with hostile legislation. The decree of the Star Chamber in 1637, which limited the number of English printers, did not check the growth of printing more effectually than the stamp duty of four pence levied in 1815 on every English newspaper. Printers everywhere had to encounter disabilities made by society as well as by law. Even in America, Franklin's brother was practically boycotted in Boston, Bradford had to leave Philadelphia for New York, and Zenger of New York had to stand trial for criminal libel in making proper comment. At an earlier date Governor Berkeley of Virginia thanked God that there were no printers in that colony, and hoped that there would be none. Printers had to be content with conditions as they were. They had little inducement to improve their workmanship or to extend their field of activity.

Yet among the critical there was dissatisfaction at mean printing. As early as 1733 Pyne, vexed at the meanness of English typography, had two volumes of Virgil engraved and printed by copper-plate process, which gave him clearer letters, blacker ink, and better decoration. Between 1791 and 1793, English authors had books printed by Bodoni at Parma, who made them in a style then unapproachable in England. Bewick of Newcastle was then engraving woodcuts that could not be fairly printed on the hand-press. Ged and Tilloch of Edinburgh were vainly trying to introduce the art of stereotyping. William Nicholson of London tried to improve the press, and took out a patent in 1790 for these improvements: (1) tapering types that could be fastened on a cylinder; (2) cylindrical inking-rollers of leather; (3) two cylinders working concurrently and printing a sheet of paper passed between them; but he did not perfect any one of these devices.

The first noticeable improvement was made by Earl Stanhope, who, in 1798, invented a hand-press entirely of iron which could properly print one side of a large sheet by one impression. The mechanism was entirely his own, but the practicability of a large platen for the printing of one side of a sheet had been demonstrated by M. Pierres of Paris as early as 1786. The iron press lightened labour, but it did not increase production, which was sorely needed. In 1804, König of Saxony went to London with the model of an improved platen press intended to be self-inking, and to more than double the performance of the old hand-press. After many years of experiment he had to abandon all efforts to improve the old method of printing from two flat surfaces, but he was entirely successful in his method of printing upon a flat surface from a rotating cylinder. The machine so constructed was fairly tested on a book form in 1811, and was put to regular use on the London *Times* in 1814. This machine was a turning-point in printing, for it demonstrated the greater speed and merit of the cylinder movement. König had been materially helped in his experiments by many English inventors who developed his imperfect plans — of whom Bensley and Napier most deserve notice. The König and Bensley machine, which printed one side only of the sheet, was followed after a while by the double-cylinder, which printed on the forward and the return movement of the form at the rate of fifteen or eighteen hundred perfect copies in an hour, as well as on either side of the sheet, and with this performance newspapers had to be content for many years.

Improvements in printing machinery would have been relatively ineffective if paper had not been provided in larger sheets, of uniform thickness, and at lower price. In 1799, Louis Robert of France, aided by Leger St. Didot, invented a machine for making paper in a continuous web. After the expenditure of much money in

correcting its imperfections, the brothers H. and S. Fourdrinier of London made the machine practicable in 1805, and it has ever since been used and known as the Fourdrinier machine. Its introduction was strongly resisted by the workmen, who magnified its defects. It was not until 1827 that it was introduced in the United States. At that time and for many years afterwards printing paper was made almost exclusively of cotton fibre. When the supply of rags was not equal to the demand, straw and fibrous grasses proved fair substitutes. In 1860, Henry Voelter invented an apparatus for grinding soft woods like pine and hemlock into a pulp, from which paper was easily made. Between 1853 and 1858 many new methods were introduced of making paper stock from chipped wood treated with acids or alkalies. Under the new treatment paper was made with longer fibres and of better quality, and the cost of manufacture has been largely reduced. The high speed maintained on machines by all newspapers of large circulation depends quite as much on cheap paper and a continuous web as it does on the improved machinery for presswork.

Fast-printing machinery would have been impracticable without cylindrical inking-rollers made of glue and molasses, a material which had been used in the Staffordshire potteries for many years. Its adaptability for receiving and imparting ink or colour was perceived by some unknown English printer, who induced the makers of cylinder presses to try the novel compound, as rollers of leather and india-rubber had been found ineffective. Without the swift-moving composition roller there could be no inking of type on fast machines. It was the slow, dabbing movement of the old inking-ball that made König fail in all attempts to quicken the hand-press and his first cylinder machine.

Another contribution to the development of book printing was the art of stereotype, made practicable by

Earl Stanhope about 1804. Under the old conditions a publisher did not dare to print a large number of copies of any book unless he believed it would have quick sale. Books were bulky, and took up too much space. Consequently, the types for a first edition were distributed when they left the press; they had to be reset, with renewed chances of error in the second edition. Resetting for two or more editions added largely to the cost of the book and limited its supply. The process first used, known as the plaster process, served book printers fairly for types for about fifty years, but it failed for engravings, and was too slow and troublesome for daily newspapers. The practice of the art was brought to New York by David Bruce in 1813, but the first book stereotyped in America was the *Westminster Catechism*, made by J. Watts & Co. of New York in June of the same year. The clay process of stereotyping, ruder but quicker and cheaper, met with small favour. The *papier-maché* process, invented by Genoux of France in 1829, by which a mould of the type can be taken on prepared paper, is the process now preferred by all newspapers, but they refused it for many years. For the printing of books, all methods of stereotyping have been superseded by the more recent art of electrotyping, which was experimentally tried in New York as early as 1841 by Professor Mapes, and was in general use in this city before 1855.

Although important improvements in printing-machinery were first made in England, English machines, and, indeed, those of other European countries, have never been common in the United States. The productions of American builders of presses and founders of type are preferred at higher prices because they have been made to meet local requirements. Much of American invention is based on new principles. After König's failure to make a quicker platen press, foreign inventors gave up the platen movement as impracticable, but Isaac Adams

of Boston took it up from a new point of departure and made it successful. In 1827, he constructed the machine now known as the Adams power press. As first made, it was a rude affair, with frame of wood, and fitted for sheets of small size, but it was afterward made of iron entirely and enlarged and improved so that it could print a sheet, on one side only, of 30 x 40 inches, at the rate of eight hundred sheets an hour. Considering the larger surface printed, as well as its greater speed, the improved Adams press did in one day the work of ten hand-presses quite as well as it had been done before, for its provisions for inking and exact register were of the best. For more than fifty years it was the machine preferred for book printing. Nor is it yet out of fashion. The Riverside Press has a large number in daily use.

As cylinder machines had been found indispensable in the printing of newspapers, they were exclusively used in every large city for that purpose. Book printers did not like them, for as first made, after early patterns, they wore type badly. The American Bible Society tried to utilise the cylinder for printing Bibles, but had to put them aside as too destructive to type. Daniel Fanshaw was equally unsuccessful. Pressmen stigmatised the cylinders as the " type-smashers," and those that I saw in 1849 in some printing-houses of this city fairly deserved the name. In 1835, Harper & Brothers printed all their books on hand-presses, for they had no machines of any kind. The New York *Sun* was first printed on the hand-press. Two or three men, working strenuously in reliefs of fifteen minutes, were able to print about four hundred or five hundred sheets in an hour on one side only. Greater production was impossible. As late as 1849 the firm of Banks & Gould printed all its law books on the hand-press, but this was the last attempt in New York City to make it available for commercial book work.

All New York daily newspapers before 1850, of the

class of the *Evening Post* or the *Courier and Enquirer*, were large sheets of four pages only, for it was then better to have four large than eight smaller pages. Although the double-cylinder perfecting press, which printed on two sides at one operation, was then known and used, two cylinder presses were sometimes required —one to print one side and another to print the reverse side of the sheet. When each machine had quick feeders it was possible for the two to produce thirty-five hundred impressions in an hour, but the average performance was not so large. This product was too small for any paper with increasing circulation. Forms had to go to press early, to the shutting-out of news, and finish late, to the annoyance of subscribers. The old morning-paper press-room was a Babel of confusion, for the work of printing was seriously impeded by feeders and paper-folders, who were often in the way of the pressmen.

A successful attempt to increase production was that of R. Hoe & Co., who, in 1847, invented a rotary press with four-impression cylinders, which turned out four papers, printed on one side, at every revolution of the central cylinder that contained the form of type. The secure fastening of movable type on the curved surface of the central cylinder was accomplished by a simple and effective method. Machines with six-, eight-, and ten-impression cylinders were afterwards made, which produced from five to twelve thousand impressions in an hour. Each cylinder required a separate feeder. For many years this press had great popularity. First used on the Philadelphia *Ledger* in 1847, it soon found its way to New York, London, and Paris. Although it increased performance largely, it did not overcome all the difficulties. A second rotary machine was needed to print the paper on the second side, and the folding of the papers had to be done by the old method.

In the first World's Fair, held at London in 1850,

Thomas Nelson of Edinburgh exhibited as a mechanical toy (for he and the public regarded it as nothing better) a little cylinder printing-machine, which printed at one operation, from an endless roll of paper, a small handbill on both sides. The feasibility of a larger machine was not appreciated by European press-builders, but the principle was successfully utilised by William Bullock, who, in 1865, was the first to make a machine which printed a large newspaper successfully on both sides of a continuous web of paper. This machine, which enabled the newspaper publisher to print ten thousand copies within an hour without the assistance of feeders, was regarded as a great improvement. Yet it had two serious defects, for it did not neatly deliver and could not fold the printed sheets.

The defects noticeable in the Bullock press and in rival rotary machines, then made by Walter of the London *Times* and by Marinoni of Paris, were fairly overcome in a new form of rotary machine first known as the web press, made by R. Hoe & Co., and first used by the *Tribune* in 1871, which printed from plates stereotyped in the curve at the rate of ten or twelve thousand copies in an hour, and piled the printed copies, counted and folded, ready for instant delivery. Its high speed was not its only merit. Feed-boys and fly-boys, counters and folders, were needed no more, and their withdrawal was a relief to the overcrowded pressroom.

When new machinery and improvements in the treatment of wood fibre warranted manufacturers in lowering the price of paper, publishers of newspapers began to issue supplements and double sheets. The old-time four-page paper sometimes appeared with a supplement of two pages, and then again as a double sheet of eight pages, and afterward, when paper had been further cheapened, in a combination (for Sunday editions) of three, four, or five sheets of eight pages each. To do

this work properly the sheets had to be folded (sometimes pasted and folded), inserted in proper order, and automatically counted. For the different requirements of an eight-page or a forty-page paper the web press had to be reconstructed again on new lines. Two or more machines feeding separate rolls of paper were geared together (sometimes at right angles to save room) as one machine, but they kept time and pace exactly, and did perfect as well as rapid work. In this space it is not practicable to describe the quadruple, the sextuple, the octuple, and the six-colour rotary printing-machines made by R. Hoe & Co, which are now successfully at work in many cities, producing newspapers of few or many pages at speeds varying from twelve to seventy thousand copies an hour. Machines of merit have been invented by other press-builders. The last improvement in newspaper printing favours a greater compactness and directness, as is shown in the Goss (straight-line) machine, which prints from four distinct rolls of paper that send out separate sheets on parallel lines, and unites them, after cutting, in folded copies.

The printing-machines now most used for book and job work are much simpler, for they have been constructed to produce accurate more than rapid workmanship. The small machines respectively known as the Yankee card press, Ruggles job press, and Gordon press, made about fifty years ago for job printers, which printed petty work like cards, circulars, and handbills better than it could have been done on the hand-press or the cylinder press then in use, were the simple models that compelled press-builders to be more exact in the construction of cylinder presses for book work. To keep pace with these improvements the cylinder press of 1850 had to be reconstructed. Two new forms were made—the two-revolution cylinder and the stop-cylinder, the one last named the invention of Dutartre of France in 1852. On the

two-revolution cylinder, a performance of fifteen to eighteen hundred impressions could be had in one hour; on the stop-cylinder of the same size, about ten or twelve hundred impressions an hour. When managed by an expert pressman, the quality of the work done on these machines could be made equal, and in some features superior, to anything done on the Adams platen press.

In 1870, a great change took place in the methods of book printing. To receive a good impression from types it always had been thought necessary that paper be dampened and made pliable before printing. As an aid to this good impression an elastic woollen or india-rubber blanket was used for the impressing surface. When types only were printed, the dampened paper and elastic impression made strong and easily readable print, but this method that was good for types was bad for woodcuts, in which shallow engraving was unavoidable. Elastic impression pressed surplus ink in the counters, or depressions, of the engravings, and seriously damaged the contrasts of light and shade made by the engraver. Printers of cards and circulars on dry and smooth paper had already proved that it was possible to print sharp lines clearly without dampening the paper, and the printers of books, following this lead, began to use calendered paper and to print it dry, with better effect on woodcuts. The new method of printing compelled much greater care in the adjustment of impression on the type and woodcuts, but it saved the expense of wetting the paper and of smoothing the sheets in the hydraulic press after impression.

In 1880, the recently discovered art of photo-engraving had been developed to such an extent that it was supplanting woodcuts as illustrations in pictorial magazines and books. The counters or depressed surfaces made by this process were so shallow that they could not be properly printed even on ordinary calendered paper. Paper-

makers removed this objection by covering a thin fabric of paper with a thick coat of whiting, which, after repeated calendering, left it with a surface as smooth as polished glass. On this coated paper it was possible for an expert pressman to bring out a delicacy from a relief plate almost equal to that made by photography or stipple engraving, and consequently coated paper has been the fabric most approved for the printing of fine illustrations. It was soon found that delicate lines and receding perspective were had at the expense of strength, for photo-engravings as first made were weak and monotonous. The engraver on wood, whose art was threatened with extinction, had to be recalled to burnish and touch up the weak spots of feeble half-tone plates. So treated, photo-engraving made merchantable illustrations. The value of this relatively new art in the reproduction of pen drawings, facsimiles of old prints, and writings cannot be overestimated.

In 1884, the circulation of illustrated magazines had increased so largely that it was impracticable to print them properly and in time on any form of flat-bed cylinder press. A new form of web press was made by R. Hoe & Co. for the advertising forms and plain forms of the *Century Magazine*, which printed them from curved electrotype plates and performed the work of ten cylinder presses in an entirely satisfactory manner. The success of this machine led the same mechanicians to make for the same periodical the rotary art press. This machine also prints, from curved plates, sixty-four pages of the magazine at each revolution quite as well as it had been done on the ordinary stop-cylinder. Although rotary machines have been found indispensable in newspaper offices that use only one size of paper, they have not been found generally useful in book printing-houses, which have to print upon many sizes of paper from different sizes and numbers of pages. The rotary press

compels the use of a sheet (after it has been cut from the web) no longer or shorter than the circumference of its cylinder. Nothing more seems to be needed in the speed of modern printing-machinery, but improvements are needed in printing-ink, printing-paper, and improved methods of preparing type for printing, known under the pressman's phrase of " making ready."

Type-setting and type-making machinery received great improvements during the last half of the century. In 1853, William H. Mitchel invented a type-setting machine which was used for many years in the office of the late John F. Trow. It failed to meet general approval because of the inventor's inability to produce an equally good type-distributing machine. After Mitchel came not less than a score of inventors, who devised machines of greater or less merit. The machine most in favour at the present time, most largely used by newspapers, is the Mergenthaler or Linotype, which does the work of many men. Without this machine, which has cheapened type-setting, our newspapers could not afford to furnish so great an amount of reading-matter.

During the last ten years new fashions in typography have appeared. For more than three hundred years each generation of printers followed more or less faithfully in the paths made by their predecessors, without attempting to create new forms of letters or new styles in photography. When Bodoni of Italy, at the close of the last century, made types with sharp lines, and when good French and English engravers began to imitate copper-plate methods on woodcuts, every tendency toward a greater delicacy of print was sedulously cultivated by publishers, engravers, and typefounders. This feminine style of typography reached its highest development in 1870. Then came the rebound. Not long after, Andrew Tuer of London began to reprint old English chap-books that were noticeable for rudeness, blackness, and

uncouthness. In 1890, William Morris of London established the Kelmscott Press for the reproduction of old books in mediæval style. He made for his exclusive use Roman and Gothic types of new forms and great blackness, which he graced with initials and borders after monastic designs. This revival of a thoroughly masculine style of typography had many features of high merit which were properly admired, but unfortunately it has met with imitators who copied its form and missed its spirit. Amateurs in typography have been encouraged to attempt imitations of coarse styles of printing done in the sixteenth and seventeenth centuries. Typefounders, following in their steps, have recently produced letters and decorations more uncouth than those of the printers of any age or country. The good models made by able men for four centuries have been supplanted for advertising purposes by the clumsy letters of schoolboys. This affectation of clownish simplicity, which plunges letter-designing in a pit of slovenliness, is but a passing fashion.

The nineteenth has been a century of wonderful achievement in every branch of printing. The Fourdrinier paper-making machine, the Bruce type-caster, the Linotype type-casting and type-setting machine, and other mechanical type-setters of merit; composition inking-rollers, the cylinder press, the web press, and mechanisms of many kinds for the rapid printing of the smallest label or the largest sheet in black or many colours; machines for folding, sewing, and binding books; the arts of stereotype, electrotype, and photo-engraving—all these are its outgrowth, and the more important have been invented or made practicable within the memory of men now living. It is a summary of which the printing trade may be proud; but whether printers have made the best use of their great advantages is another question not to be answered too confidently. Printing was never done better and never done worse;

never was cheaper, never was dearer, than it is to-day. It has never been furnished in so large a quantity at so small a price. For two or more cents can be had a newspaper with more reading-matter than would fill a stout octavo volume. Yet books are made and sold in limited editions to eager subscribers at prices ranging from five to fifty dollars a volume. There is much difference of opinion concerning the quality of printing now done. William Morris maintained that printing had gone steadily from bad to worse until he revived its best features. Many publishers maintain, with more reason, that books of real value for instruction or amusement were never better fitted than they now are for usefulness to all classes of readers.

THE BIRTH AND PROGRESS OF PHOTOGRAPHY

By John Nicol

ALTHOUGH, long before the advent of the nineteenth century, men had wished for a method of fixing the fleeting image of the camera obscura, and some had even made promising attempts in various directions, it was not until that century was one third passed that anything really worthy of the name had been accomplished. Practical photography first saw the light in 1839. On February 21st of that year, Talbot, who had obtained permanent prints and camera images as early as 1835, published his process; Daguerre's was published on August 19th; and somewhere between those dates, Mungo Ponton, in a paper read at a meeting of the Royal Scottish Society of Arts, made known to the world his discovery that soluble organic matter, in the presence of an alkaline bichromate, was rendered insoluble by exposure to light—a discovery the value of which was not recognised for some years, but which is the basis of all that is included in "process work."

Talbot and Daguerre had been working independently and without knowledge of each other for several years, the former alone and on scientific methods, having been a student of science, especially chemistry, from his school days; the latter empirically and, for some time before he reached the goal, in conjunction with Niepce. Niepce had been working at the problem since 1814. He obtained camera images in 1827, and two years later, at the

solicitation of Daguerre, entered into partnership with him. From the documentary evidence available, it appears that, while Niepce had much to communicate, Daguerre had nothing to bring into the copartnership but an improved camera, and it is at least certain that the suggestion of the action of iodine on a silver plate—which led to ultimate success — came from Niepce. Be that as it may, it is worthy of notice that, working on different lines and with different material, Talbot and Daguerre found success in the same metallic haloid, the same silver iodide, although made in a very different way and giving very different results. Daguerre's process, to which he had given the name " daguerreotype," consisted in exposing the highly polished surface of a silver plate, or a copper plate coated with silver, to the vapour of iodine. The silver iodide thus formed passed through various colours, depending on the length of the exposure, and experience soon showed the colour which had the highest degree of sensitiveness. This, on exposure in the camera, produced no visible image, but on exposing the plate to the vapour of mercury (such small quantity as arose from a temperature of about 140°) an image was developed, the mercury vapour having adhered to such parts as had been acted on by light, and in proportion to the quantity or intensity of that light.

The image thus formed was of exquisite delicacy, the minuteness of its detail being limited only by the degree of perfection of the optical appliances; but the process was slow, requiring an exposure of minutes. Nearly a year later, Goddard in England and another of the same name in America added bromine, which reduced the exposure to seconds. About the same time an improvement hardly less important was made by Fizeau, known as " gilding," the deposition of an extremely fine film of gold on the surface of the plate, which materially added

to the beauty and permanence of the image. The weak point of the daguerrotype, which soon made it practically a lost or forgotten art, was that it could not be duplicated or multiplied. Each exposure yielded a picture complete in itself, but only one, a positive; whereas the altogether easier, although apparently more complicated, method of Talbot gave a negative that could be duplicated or multiplied to any extent.

Talbot's process ("calotype," he termed it, but better known by his own name) had paper for its support, and according to his first description was made as follows: a sheet of paper was brushed over with a solution of silver nitrate, dried, and dipped into a solution of potassium iodide, and again dried. This he called iodised paper; it was hardly if at all sensitive to light, and would keep indefinitely. To make it sensitive, it was brushed over with what he called gallo-nitrate of silver, a mixture of solutions of silver nitrate and gallic acid; and after exposure in the camera the image was developed by brushing over with the same solution and the application of a gentle heat. The image so produced was a "negative"; that is, the lights and shades were reversed, darks in the subject being represented by lights or white paper, and vice versa. The advantage of this lay in the fact that a sheet of the same paper placed under this negative and exposed to light resulted in a "positive," an image in which the lights and darks were in their right position; and that an unlimited number of such positives could be made from such negative. But as positives on calotype paper would require development, the same as the negative, Talbot recommended the employment of the silver-chloride paper first brought before the Royal Society, which simply required exposure to light, or what is now known as "printing-out paper." To facilitate this printing, and to get rid as far as possible of the grain of the paper, he subsequently saturated it with wax; and, later

on, paper iodised and waxed, or "waxed paper," became an article of commerce.

Only those who lived through it can realise the interest and excitement that followed the introduction of those two similar yet very different methods of photography; similar, in that they relied on the same haloid salt for their result, but different in their methods of producing it and the material on which it was supported, and vastly different in their possibilities. Daguerre's name was on every tongue, and his process was dabbled in by every one possessing a smattering of science, until, within a very short time, there was hardly a town of any considerable size that had not its professional daguerreotypist, or a middle-class home without several of the wonderfully beautiful pictures. About this time, too, the "amateur" may be said to have come on the stage. Le Gray's wax-paper process, a modification of the talbo-type, which consisted in waxing the paper before iodising it, had come into use; and although it was slow it yielded fine results; so fine, indeed, that some of the negatives made then are quite equal to anything turned out at the present time, notwithstanding all the improvements that have followed. Mention may also be made here of what was known as the albumen process, first proposed by Niepce de St. Victor, a nephew of the original Niepce, but perfected by Le Gray. Iodised albumen was spread on a glass plate and sensitised by immersion in a solution of silver nitrate; and it gave results that for delicacy of detail have not been equalled except by the daguerreotype; results so perfect that for certain purposes—such as transparencies for the stereoscope and for enlarging—it has no equal, and, consequently, is still in use.

Things continued thus with little more than simple modifications till 1850, when the introduction of a practical method of employing collodion as the sensitive film and glass as its support gave photography a new impetus.

Collodion, a solution of a variety of gun-cotton in a mixture of alcohol and ether, was suggested by Le Gray, but it remained for Archer of London to give it a practical form, and it took like wildfire. Compared with the daguerreotype, it was simplicity itself, while in delicacy of detail and beauty it was not far behind; and, more important still, the image might be either positive, so as to be available at once, or negative, with all the advantages of unlimited multiplication. The image on a collodion plate is positive when examined by reflected, and negative by transmitted, light. With a comparatively short exposure and development, the plate needs only backing with some black substance to supply the shadows, to convert it into a very beautiful picture. With longer exposure, and development continued until the highest lights are opaque, followed by intensification, if need be, the image is negative, and capable of giving prints of the very highest quality. From this duality of the collodion film there arose two classes of professional photographers: the few, with higher ideals and catering to the better class of the people, stuck to negatives of considerable size, generally "whole plate"—8½ x 6½—supplying only one print at a time. The other class, the many, contented themselves with positives, and generally of the smaller sizes; and although the prices were low the demand was great, and they could be turned out in large numbers. But fashions in photography change, and the *carte-de-visite* soon displaced the glass positive, or, as it was called in America, "ambrotype," and with it came ordering by the dozen, a practice that has remained with us ever since.

But collodion, or "wet collodion," as in the light of after developments it was called, however convenient for the professional, heavily taxed the amateur who went afield. The plates had to be prepared and finished on the spot, which entailed, even when the smaller sizes only were

used, the transportation of an amount of apparatus and material that would stagger a modern amateur. My favourite size was 11 x 9, selected because I could get four prints from one sheet of paper; and the weight of the necessary outfit, including dark tent, plates, and plate-box, a glass bath holding half a gallon of solution, tray and water-tank, and some half-dozen of pint bottles full to the brim of the necessary chemicals, was not less than seventy pounds. This led to a demand for a process that could be employed in the field as easily as wax paper, and, after many attempts, the result was what was then known as "dry collodion." A dry-collodion plate differed from a wet in having the free silver nitrate washed away; but if then dried and exposed, only a weak, useless image could be obtained, as it required something to take the place of the silver as an absorber of the liberated iodine and bromine. This absorber, or sensitiser, as it was called, was, first, certain preparations of gelatine, then tannin, and, ultimately, almost any kind of soluble organic matter,—tea, coffee, malt, beer, albumen, etc. But such plates were slow,—five, ten, and fifteen minutes being quite usual, even on well-lighted landscapes,—and although it was a great relief to have nothing to take to the field but a dozen plates in half as many double slides or plate-holders, the amateur was not satisfied.

The next great step in advance was the introduction by Syce and Bolton of the "collodio-bromide emulsion." This did away with the troublesome preparation of the plate in the silver bath, it being only necessary to pour the sensitised emulsion directly on the plate and set it up to dry. Exposures were now much shorter, but still far behind wet collodion, and so the search for greater rapidity continued. The emulsion idea was really the turning-point. For the best results, an absorber—some kind of organic matter in addition to the pyroxylin—was required, and it occurred to King first (although several

others claim the credit) to substitute gelatine for pyroxylin, and to him belongs the honour of making the first picture on a gelatino-bromide emulsion. The history of the gelatino-bromide plate, which is the plate in universal use at the present time, may be briefly told. Only certain kinds of gelatine are suitable, and much time was spent in discovering which was the best. Much time was also lost from underestimating its sensitiveness. Gradually, however, in the hands of the amateur it displaced collodio-bromide, and with a sensitiveness about equal to that of wet collodion, hitherto the standard, he went ahead satisfied, the time having been reduced from minutes to seconds. The simplicity and certainty of the gelatine plate, and especially the fact that several factories had been established for its preparation, won for it the adhesion of large numbers of amateurs, although the professional continued to employ wet collodion. But his conservatism was soon overcome. At a meeting of one of the London societies, Bennett showed some negatives taken with exposures hitherto undreamed of as a result of " cooking " the emulsion, that is, of keeping it at a comparatively high temperature for some hours after it had been otherwise finished. Plate makers saw the advantage of this, and in a short time were advertising plates " twenty," " thirty," and even " fifty times," wet collodion, as I have said, being the standard.

The professional could not resist this, and in a short time wet collodion was abandoned in every studio, and plate-making factories were established in every country. For some time many amateurs continued to make their own plates, but the commercial article improved so rapidly, and the price became so low, that they found it both better and cheaper to buy than to make; and at the present time the commercial plate has reached a degree of perfection, both in quality and sensitiveness, beyond which it would be unreasonable to look for improvement.

The only objection is the weight and brittleness of the glass support, and that affects mainly the amateur and the landscapist; and at present efforts are being made in various directions to overcome it. Films of celluloid, both in cut sizes and in rolls, have been in use for some time, but are, by many at least, regarded with suspicion, on account of alleged instability. Gelatine is considered more promising, and during the present season several factories have been started, each claiming to make a film with that for its basis, which possesses all the good qualities of glass plates without any of their drawbacks, and at prices as low, if not lower, than glass.

Printing methods in photography have been as varied, and their improvement as great, as in the case of the negative. At first, prints were made on plain silver-chloride paper, and when the ammonia nitrate was substituted for the plain nitrate, some were made that are not excelled by anything at the present day. The desirer of greater detail, however, brought into use albuminised paper, which not only came into universal use, but held its sway until comparatively recent times. About a decade ago it was displaced by paper coated with a chloride emulsion, a highly glossy family generally known as the "aristo." This still continues in use by the less artistic amateurs and the less important professionals; but the best practitioners of either sort have long abandoned the highly glossy surface for various methods that give "matt" or plain-paper prints. The principal, or the most generally employed, are the "carbon" and the "platinum" methods, both introduced in the sixties, though both lay dormant for many years.

Carbon, probably the best of all printing methods, although platinum is a close second, is more of a mechanical than a chemical process. It uses a paper coated with bichromated gelatine, coloured with finely divided carbon or other pigment. This is exposed under a negative, and

wherever light has reached the " tissue," as it is called, and just in proportion to the quantity or intensity of that light, the gelatine becomes insoluble. Immersed in warm water, the soluble parts of the tissue (those protected by the opaque or semi-opaque parts of the negative, and consequently the lights of the picture) soften and are washed away. Just who first proposed carbon it is difficult to say. Fargier, in France, was early in the field, but to Swan of England is due the credit of first making it a practical process; although Blair of Perth, Scotland, was the first to recognise the crucial part of it—the necessity for *exposing through the back of the tissue*, or, in other words, developing from the side opposite to that which was exposed. Platinum was introduced by Willis of England, and is based on the fact that a platinum salt is reduced to its metal in the presence of potassium oxalate and a ferrous salt of iron. At first the paper was coated with the ferric salt of iron and exposed to light under the negative, the light changing the ferric to the ferrous salt. Development was effected by a hot solution, a mixture of the oxalate and the platinum sålts; but more recently the platinum has been mixed with the iron, and development carried on in a cold solution of potassium oxalate.

Not the least important of what may be called the side issues, or secondary applications, of photography are the various productions generally included under " process work ": photogravure, half-tone, collotype, photolithography, swelled gelatine, etc., all the various methods used for book and magazine illustration, and some of which are employed in almost every printing-office in the land. Here, too, Talbot seems to have been the pioneer. It is true that Poitevin, and after him Fizeau, made intaglio plates by depositing copper on a developed, but not fixed, daguerreotype; but such could never become commercially available; while, as early as 1843, we know that he was working at a method of engraving on metal prints

from his negatives, and in 1852 and 1858 he took out patents for his methods. In the first he coated a steel plate with bichromated gelatine and exposed it to light, for from fifteen to thirty minutes, under the negative, soaked or washed in water, soaked in alcohol, and dried. To break up the deeper shadows, he printed under crape, and even glass with ruled lines, and etched with platinic chloride applied with a brush. He also covered a plate with an aquatint ground, consisting of particles of resin applied before coating it with the gelatine. In the second method, in addition to various modifications, he dusted the printed plate with powdered resin, fixed it by heating, and etched with perchloride of iron. So well, indeed, had he studied the subject, that the photogravure of the present day is almost identical with that patented by him in 1858, and prints from those plates, which he gave me a year later, and which lie before me now, compare favourably with most of the work of the present time.

The desire to reproduce photographs in printer's ink seems to have set many others experimenting in various directions, and the method now known as "collotype" was one of the earliest. It has undergone various modifications, but "albertype" may be taken as one of the best, as it was in its day the most generally employed. A glass plate was thickly coated with bichromated gelatine, and to give it the necessary hardness a little chrome alum was added. It was first exposed to light for a short time on the glass side, and then under a negative in the ordinary way, till the desired impression was made. Soaked in water, only the parts not acted on by light absorbed it sufficiently to refuse to take ink from the lithographic roller, and in this way excellent prints in half-tone were made. It was known as "lightdruck," "heliotype," etc., and is still more or less in use. Almost as early, and still more extensively employed, was photolithography.

Asser of Amsterdam was the first to put it to practical use, but probably it is to Osborne of Melbourne that we are indebted for the modifications which made it the process now employed by every map-maker in the world. Briefly, a sheet of suitable paper is coated by floating on a solution of bichromated gelatine or albumen; printed under a negative, and inked either by a roller or, better still, by spreading the ink evenly on a stone, and passing the paper through the press once or twice as if drawing a proof. The inked sheet is then laid face down on warm water if gelatine has been employed, and cold if albumen. The gelatine, where light has not affected it, swells and dissolves, leaving ink only where light has acted, the parts representing the dark lines of the original. A spray with water or even a slight wash with a sponge makes it ready, after drying, for transferring to the stone, and the quality of the work will depend on the care given to the preparation of the transfer.

But the two most generally employed methods of reproduction are the " photogravure " and the " half-tone "; the former for the reproduction of paintings and photographs for high-class book illustration, which, being an intaglio production, is printed in the copper-plate press, and consequently more costly than the latter. Particular methods are generally kept as trade secrets, but something like the following is usually adopted: a negative is first made from the painting or photograph, and from this a positive. The positive is printed on a plate of copper coated with a solution of bitumen, which, as was discovered by Niepce, becomes insoluble on exposure to light. The plate is then soaked in oil of lavender or other solvent of bitumen, and etched. Half-tone, however, is by far the most important of all the " process " methods. It has revolutionised book and especially magazine illustration, made wood engraving almost a lost art, and, by its accurate reproduction of the photograph, given to

illustrated books of travel and natural history a value they did not previously possess. As with photogravure, half-tone blocks may be produced in various ways, and some of them are regarded as trade secrets; but the following is the method most frequently adopted: from the photograph, preferably on glossy paper, is made a negative; and to break it up into the necessary dots the plate is exposed under a lined screen. The lines may be all the way from eighty to two hundred and fifty per inch, depending on the purpose for which the block is to be employed; a "screen" consisting of two ruled plates, placed face to face, with the lines at right angles or otherwise crossed, and cemented together. The negative must also be reversed from right to left, and this may be accomplished either by a prism or a mirror placed in front of the lens of the copying camera, or by stripping the negative from its glass support and reversing it while printing on the copper. The shape and size of the diaphragm opening is also of importance, as it acts in conjunction with the screen, and has considerable influence on the nature of the dots.

Photography in natural colours, or, as Sir W. de W. Abney has it, "in the colours of nature," has, almost from the first, been the dream of many experimenters, but, notwithstanding all that has been done, we are no nearer to it than when they began. Colour photography, however,— that is, photographs having the semblance of the natural colours,— has made considerable progress. Becquerel was the first to secure on silver chloride something approaching the colours of the spectrum, but got no farther; and to Ducos du Haroun is due the credit for, in 1869, clearly foreshadowing the three methods which include all that has yet been done in it—the superimposing of three-colour images, Joly-McDonough coloured lines, and Lippmann's interference process. Taking them in the order of their least importance, Lippmann's method is to expose a very thin sensitive film, backed by mercury

as a reflector, to the coloured object. Incident light reflected from the metallic mirror in contact with the film results in interference, and, as the constituents of white light are of varied wave-lengths, it produces in the film a series of planes parallel with its surface, and emitting coloured light exactly as does the soap-bubble; but the process is difficult, and not likely ever to be more than a scientific curiosity. In the Joly-McDonough method a negative is made in the ordinary way, but with a glass plate with closely ruled coloured lines in front of and in contact with the sensitive plate. From the negative so made a positive is printed, and a second or viewing screen with similar coloured lines is placed in contact with it, and in exact register with the impressed lines, the result being a picture in the semblance of the natural colours. The positive may be either on glass or paper, and as it is proposed to employ it for book illustration, the Colour Photo Company, which has secured both the American and European rights, must see their way to overcome the difficulty of ruling some thin transparent pellicle for viewing screens.

The "three-colour" method is the most important, as it has the greatest commercial possibilities, and gives the most varied and most satisfactory results. Although Collen, in 1865, was probably the first to suggest the method, and Du Haroun, in 1869, outlined it clearly, they and those that followed them were on the wrong track, working on the theory of Brewster, which never could lead to success, instead of that of Young, Helmholtz, and Maxwell, now universally accepted. The first to recognise this was Ives of Philadelphia, and to him more than to any other, or indeed to all the others together, are we indebted for the great progress that has already been made. Briefly, three negatives — colour records they may be called—are made on orthochromatic plates; plates, that is, made more or less sensitive to the

green and red of the spectrum as well as to the blue, each exposed under a suitable coloured screen or colour filter. Each of the negatives so made includes practically only one of the series of three wave-lengths that, separated, produce the sensation of colour, and when combined that of white light. From these negatives half-tone blocks are made and printed, one over the other, in suitably coloured inks.

In scientific investigation photography has been remarkably helpful. It has taken the place of manual labour in record-keeping, measured the velocity of flying bullets, shown the true positions of animals in motion, and created the "new astronomy." As early as 1840, Draper had made photographs of the moon; in 1857, De la Rue established heliographic observation of sun spots, a work begun at Kew and continued at Greenwich till the present time. Employed in every solar eclipse since 1860, photography has told us all that we know of the corona and chromosphere; it has revealed the mystery of the hitherto puzzling nebulæ, and, by virtue of the fact that the light action is cumulative, has told of the existence of stars so far away as to be beyond the ken of the human eye, aided by the most powerful telescope yet made. At the Astro-photographic Congress that met in Paris in 1887, it was resolved to make a photographic survey and star-map of the heavens, and at present there are eighteen telescopes, each of thirteen-inch aperture, engaged in that work in various parts of the world, while in most of the more important observatories photography and the spectroscope are joined together and made daily, or rather nightly, to tell us more and more of the mystery of the heavens.

As an educational adjunct, photography has played an important part. The projection lantern finds a place in every well-equipped lecture-room, and the photographic lantern-slide lends itself equally to the teaching of science

and the illustration of travel. The beauty and accuracy of the photographic lantern-slide, and the ease with which it is made, make it equally available to the college professor and the itinerant lecturer, enabling the one to show to a whole class what otherwise would require to be handled by the members one by one; and giving to the other an opportunity of making a comfortable living, and in some cases amassing a fortune, by amusing and instructing the popular audience. Hardly less important, although much less popular, is the enlarging of small objects, "photomicrography." In bacteriology, histology, etc., its importance can hardly be overrated, affording, as it does, illustrations in works dealing with such subjects that are without a suspicion of the imperfections of draughtsmanship, and showing, as they do, when orthochromatic plates are employed, the different luminosities of the various stains.

Nor is photography less important from a social point of view. While it displaced miniature painting, a style that only the rich could enjoy, it gave a better likeness of loved ones, equally available to rich and poor. It has given us correct instead of fancy or distorted views of the manners, customs, and scenery of distant lands; enabled the cottager to decorate his walls with better pictures than were available to his richer neighbour during the earlier years of the century, and given a new interest to periodical literature by the low cost and excellent quality of its illustrations. Not less wonderful has been its influence commercially. It has created new branches of trade and manufacture, and largely increased many that were in existence before, furnishing well-paid work to hundreds of thousands of both men and women. The glass-maker and the optician have wrought together till they have given us lenses as nearly perfect as we can hope to see; the chemist has given us new materials and improved the old, building factories for the manufacture of

some by the ton that, previous to the advent of photography, were only known as curiosities of the laboratory; while the camera-maker has so exercised his ingenuity as to give us cameras of perfect workmanship and almost automatic in their action.

Such have been the birth and progress of photography during the latter two thirds of the nineteenth century. Compared with most other branches of science and art, it is still in its infancy, so that greater improvements may be looked for. But be that as it may, surely enough has been done to make the nineteenth a memorable century to the photographic historian.

PROGRESS OF ELECTRICITY FROM 1800 TO 1900

By John Trowbridge

BEFORE the year 1800, the world's knowledge of electricity was confined to observations on the attraction of electrified pith-balls, and to a few facts in regard to electric sparks. Had it not been for lightning, no one could have felt respect for the feeble manifestations of an agency which was destined in less than a hundred years to change the channels of trade, to revolutionise methods of communication, and to light the great cities of the world. Lightning was a portent of all this; but no one yet saw the beneficence in the energy that was so destructive and so terrifying. There was another feeble force, too, of which the world in 1800 knew something—the force of magnetic attraction. This was useful in the magnetic compass; but it was judged to be insignificant in other respects and totally unrelated to the force of electrical attraction, which was manifested in the case of the pith-balls, or to the forces of lightning. No one in the wildest flight of imagination saw it exalted to a Titanic force, capable, by means of its relationship to electrical attraction, of moving all the machinery of a great city.

The marvellous development of electricity which we have all seen seems to carry with it the presumption that we have a clearer knowledge of what electricity is than Benjamin Franklin had; but this presumption is not entirely warranted. We certainly know its relations to

other forms of motion, such as light and heat, better than he did. We believe that it is a wave motion; but still we cannot fully explain the fundamental experiment of the attraction of two electrified pith-balls. To the philosopher, this confession of ignorance of an agency which he can use intelligently, which is highly serviceable, but the origin of which is completely veiled from us, is most suggestive. The question immediately arises, "To what do we owe our command of this mysterious servant?" The answer to the question is this: "We owe our advance in knowledge to the careful verification of phenomena, to the improvements in machinery produced by almost microscopic measurements, and to accurate calculation."

The steps which led to our present knowledge of the manifestations of electricity can be quickly told. The first was taken by Galvani, who, just before the last century dawned, demonstrated that electricity could be produced by the contact of metals with fluids. His experiments suggested to Volta in 1800 the electric battery. Here was a means by which an electric current could be produced; and Oersted with this current showed a connection between electricity and magnetism. The current in passing through a wire near a compass-needle could change the reading of the needle, and the changes depended upon the direction in which the current flowed. There seemed to be a suspension and a hush between each of the turning-points in the history of the advance of electricity, which are typified by the stillness before a thunderstorm. Oersted's discovery was made about twenty years after Volta constructed his battery. It was more than ten years after Oersted that Joseph Henry and Michael Faraday discovered another relationship between electricity and magnetism which involved the possibility of producing currents of electricity by the motion of a magnet. This discovery was the converse

of Oersted's; the series of phenomena which it revealed embraced the subject of electromagnetism, and have led directly to the invention of the dynamo and electric motor. The world, however, did not realise in 1831 the importance of the steps taken by Henry and Faraday. Another ten years elapsed before the electric telegraph became a success. Then in 1861,—thirty years from the date of the discovery of electromagnetism,— Paccinnoti invented the armature, which Gramme improved, and we had the dynamo and the electric motor. Again, in a little more than ten years, the telephone came, and the mechanical engineers and the mechanic, thoroughly aroused to the possibilities in the practical employment of electricity, took hold with astonishing energy.

When Tyndall came to America in 1870 to deliver lectures on light and electricity, he brought with him one hundred Grove cells to produce an electric light for the purposes of demonstration. His assistant was obliged to spend two hours before each lecture in arranging these cells, filling them with acids and scraping the connections, retiring from each encounter almost asphyxiated by the irritating and poisonous fumes of nitrous-oxide gas. At the present time no lecturer on science in the halls where Tyndall spoke need spend a moment in providing a source of electricity. It is on tap, so to speak, and can be obtained by touching a button. Tyndall in his highest flight of scientific imagination did not picture a development of electricity which would light the halls in which he spoke, which would convey him to and fro with great speed through the streets which he used in going to them, and would enable him to whisper from Boston across the great prairies of the West to St. Louis.

The title of his lectures in Boston was suggestive— "Light and Electricity." Yet his imagination, greater than that of most of his contemporaries in science, failed more completely in the subject of light than in the field

of the great practical expansion of electricity. He had no inkling of the coming theory that light is but one of the manifestations of electricity, and in ten years from the date of his lectures would be so regarded by the leaders of scientific thought. When we reflect upon how much this man saw and how much was withheld from him, a feeling of self-abasement comes over us who are students of electricity. Who can foretell what the next hundred years will unveil ?

In reflecting upon the rapid advances in the employment of electricity, we are apt to overlook the aid which has been given by the improvements in the mechanic arts. It can be maintained with a great show of reason that the modern lathe, the milling machine, together with the principle of interchangeable parts in machines, have made the dynamo and the electric motor. It is said that Joseph Henry spent months in wrapping wire with cast-off gowns to insulate it for his experimental electro-magnets. Much more powerful magnets can be wound to-day in half an hour. The mechanical means of trying experiments in the practical employment of electricity have multiplied to such an extent that every mechanic can enter a field which once was occupied by only one man in America, Joseph Henry; and can enter it with the most refined appliances in respect to tools and materials. Many of the men who have aided the practical development of electricity have known little of the subject of electricity. Some who have achieved distinction as electricians were ignorant of even elementary laws; but they saw how machines could be operated by what to them was a fluid analogous in its manifestations of flow and pressure to water. Just as men were ingenious in transmitting power by pulleys, belts, and chains, they now became apt in devising circuits, switches, armatures, keys, and the multitude of devices of which one gets a realising sense in reading the advertisements in the thousand-and-one

papers and periodicals devoted to practical electricity. In a similar manner mariners had become skilful in using the winds, the scientific laws of which they had not studied. The men who have made a lifelong study of electricity are amazed in reading the reports of meetings of electrical engineers to see the photographs of hundreds of men prominent as authorities at such gatherings—men who have suddenly sprung into notice in a field where only college professors once worked. A young man seeking to become an electrical engineer is told to-day, with reason, that he should first become a mechanical engineer. This development of practical electricity through the advancing improvements in machinery will continue, undoubtedly, to be a great characteristic of American industry. The first thought, apparently, of an American mechanic when he looks at a piece of foreign-made electrical apparatus is, "How can I improve it?" He speedily tears it to pieces, puts in screws that are interchangeable, takes out clumsy devices, reduces the weight, removes useless lacquer, and makes a new thing of it—if he does not throw the whole affair on a rubbish heap heap and proceed to build a machine on an idea which he has grasped.

To the American mechanic, who, having lost his corkscrew, inserts an ordinary screw through a piece of wood in the cork and pulls it, is due much of our national progress in practical electricity. I had occasion lately to buy a modern lathe for the Jefferson Physical Laboratory, and was surprised to find that I should be obliged to wait several months for its delivery. I was informed that eighty per cent. of the products of the mills went to France and Germany, and that foreign labour working ten hours a day could not compete with American labour working eight hours on these improved lathes. There is no need of a duty on foreign machinery, for we can trust to the ingenuity of American mechanics to hold the markets.

The efforts of inventors have been turned to electrical devices to such a degree that one has to wait months for a hearing at the Patent Office, and the examiners are so bewildered, apparently, by the claims that they grant patents in the expectation that litigation will settle points which require special study and training to consider properly. In addition to the honest inventor of electrical apparatus, we have another class, who seek to cover the ground of possible advance and to reap the fruits of subsequent study by patient investigators. They stake out claims and sit down, waiting for the worker. This class is not confined to the rank of inventors. There are sensation-mongers who make predictions of what will be accomplished some day in electricity, in the hope that when arduous investigators have reached, with almost superhuman patience, the heights imagined, the suggesters will receive the rewards and the distinction. This is a phase of the use of the scientific imagination which is characteristic of the close of the nineteenth century. The workers of the next hundred years will find it hard to achieve all these outlined advances. But if the advances are not in the direction anticipated, there are other paths which the well-trained man will open, and which will lead to yet undiscovered domains richer than any hitherto attained.

We obtain a realising sense of the importance of the advance in electricity when we reflect what changes it has wought in America. The invention of the telegraph has falsified the predictions and estimates of many political economists. Sidney Smith, writing to Earl Grey after the acquisition of California, said that this marked the end of the great American Republic, for a people spread over such a vast area, having such diversified interests, and separated by such natural barriers, could not hold together. He did not foresee how strongly a light iron wire could bind San Francisco to New York. The

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introduction of the ocean cable destroyed the class of East India merchants who went down to the sea in ships. Salem harbour, in which great sailing vessels rode at anchor or drew up to busy wharves, is now deserted.

No longer can a merchant take extensive ventures in ships' cargoes, for the state of the market is throbbed every instant around the world. Thus a revolution has been caused in commerce by electricity. It is still progressing. It was a common remark, when the invention of the telephone, was made, that it could not supersede the telegraph, for the latter gave a merchant some evidence of a business transaction, while the telephone left no sign. Notwithstanding this lack of evidence, many kinds of business are now transacted over the telephone. Cotton, for instance, is bought and sold in immense quantities, without any written record of the transactions; for business honour is found to be essential, and without confidence in buyer and seller no transactions are possible. Thus electricity may be said to work for morality.

While there has been a remarkable extension in the communication of intelligence over great distances, there has been a no less remarkable one in the application of electricity to the conveyance of people and goods. Electric railroads are intersecting the United States in almost as many directions as the telegraph and telephone wires. One can travel from Boston to New York by means of such roads, and they bring a desirable element of excitement and the possibility of change of scene to the farmers' wives, once isolated on the dreary farms of New England. Here again electricity becomes an important agent in the spiritual as well as the material life of the nation. Electric motors have not yet superseded steam motors on any of the great lines, and there does not seem to be any immediate prospect of the change; for electric power cannot at present be transmitted economically one hundred miles, and the electric motor suitable for the long-distance

transmission of electrical power has not been sufficiently perfected. The accomplishment of the substitution of the electric motor for the present locomotive is something left over for the twentieth century. When this substitution is made we shall not be troubled with cinders, and forest fires will be less frequent.

The chief source of electricity is coal, and the century just closed gives no hint of a possible rival to coal unless we except water-power. There promises to be a great development in the use of waterfalls in places remote from tide-water, wherever the transportation of coal adds greatly to its cost. Thus, in Switzerland, water-power from the numerous mountain sources supplies both light and electrical power for varied industries. The great plant at Niagara Falls for the transmission of power is watched with interest, for if electrical power can be economically transmitted from the falls to New York City, the calculations in regard to the diminishing coal-supply of the world would lose their ominous character —unless the geologist can show that the world is gradually drying up. The transmission of electrical power has led to a centralisation of steam power in great cities. The small steam engines which were scattered about in numerous workshops have greatly diminished in number, and their place has been taken by electric motors supplied with current from a central station. In the same way the gas engines, which at one time seemed to be rising in importance, have largely given way to the electric motor. Thus the plans to pipe gas from central gas-manufactories to all parts of a city for power is checked by the extension of a more subtle medium, far more flexible in its applications. No one will use a gas engine if he can obtain an electric motor; for the care and repairs on a gas engine are far more burdensome than in the case of its rival. Moreover, electrical power can be obtained or shut off by merely moving a switch or touching a button.

The centralisation of power in the physical world seems to be a counterpart of that taking place in the commercial world.

On the great battle-ships, electric motors are supplanting steam engines and hydraulic engines for moving the turrets, handling the anchors and the heavy guns. This change in the method of distributing power is one of the most remarkable in the development of industry in this century. Steam is still the great moving agency in the world of industry, and electricity is produced by it. Electricity may almost be called its servant, for from a central station it generates and transmits what is like a vital fluid to every part of a great city. Steam is still the master of electricity, and there is no prospect of the economical production of electricity by any other agency. This is still the age of steam and not of electricity. The telegraph, the telephone, the electric light, and the electric motor constitute the great achievements in the practical employment of electricity. Great chemical industries are also being established, in which processes are carried on by electricity—notably the manufacture of aluminum, of calcium carbide, of the alkalies, and of carborundum.

In this brief account of the rapid progress in the practical employment of electricity, I have dwelt largely upon the aid that the advances in the mechanic arts have given to the development of this employment. The work, however, of the scholars and theorists must not be overlooked. In 1880, there were the one-fluid and the two-fluid theories of electricity — neither of which is now believed by scientific men, though these theories prevailed until nearly the middle of the century. In 1843, Joule established the doctrine of the conservation of energy, by an exact measurement of the equivalent of heat, and this measurement led to the calculation by scientific men of the electrical units, which have made possible the advances by practical men. Without this

system of units, founded strictly upon the doctrine of the conservation of energy, and the quantitative transformation of steam power into electrical power, practical men would have floundered and business men would have lost heavily in electrical ventures, the expense of which could not have been calculated. After the establishment of the doctrine of the conservation of energy came Maxwell's great hypothesis of the electro-magnetic theory of light. This theory supposes that all forms of energy—light, heat, and electricity—come to us from the sun in the form of electrical and magnetic waves. On this hypothesis, electricity and magnetism are indissolubly connected. One can be transformed into the other—light and heat are electrical. The only difference between electricity and light is in the length of waves in the ether. The century has closed with this grand generalisation, the truth of which the entire scientific world is engaged in testing. There is every prospect that it will form the most fruitful hypothesis in the century before us. The experiments of Hertz, who was the first actually to measure waves of electricity, have greatly strengthened the electro-magnetic theory of light. He showed that most of the phenomena of light-waves could be repeated with electric waves. They can be reflected, refracted, and polarised. What explanation, however, can we give, on this hypothesis, of the simple experiment of the attraction or repulsion of two electrified pith-balls—the apparently insignificant manifestation of electric force with which the century started? How can electro-magnetic waves explain this? It is, indeed, difficult to do this; and to give a reasonable supposition we have to theorise in regard to the molecular structure of matter, and the tension under which it exists when it is polarised —that is, when a positive and negative state, typified by a positively or negatively charged pith-ball, exist in the neighbourhood of other objects. Our new

knowledge of the relations of electricity to other forms of energy is probably destined to come from a careful study of the fundamental experiments of the attraction of electrified bodies. We have already entered upon this study with renewed vigour, stimulated by the discovery of the marvellous effect of the X rays in penetrating matter and in making gases better conductors of electricity. Thus we start on the new century with investigation of the same phenomena that Benjamin Franklin considered, but with a far wider comprehension of extended relations, with immensely greater experimental resources, and with a well-trained army of investigators. What has been done is small in comparison with what should be done in the next hundred years.

TRANSPORTATION

DEVELOPMENT OF THE MERCHANT MARINE

By Eugene T. Chamberlain

"IT may be said without exaggeration that the great extent and natural increase of international trade, in being the principal guarantee of the peace of the world, is the great permanent security for the uninterrupted progress of the ideas, the institutions, and the character of the human race." If this dictum of John Stuart Mill be accepted, the remarkable development of merchant shipping during the nineteenth century is more than a phase of the world's material growth; it deserves high rank among moral and civilising agencies. Merchant shipping itself testifies to the success of its peace-bearing mission.

At the beginning of the century, vessels in trade commonly were armed against possible national foes as well as against pirates. To this day the American form of clearance, in its phrase "mounted with . . . guns," is an antiquated reminder of letters of marque. The four articles of the Declaration of Paris at the middle of the century (April, 1856) were a significant mitigation of the terrors and destruction of war, and as the century closed, the President of the United States requested from Congress authority to invite the maritime Powers to incorporate into the permanent law of civilised nations the principle of the exemption of all private property at sea, not contraband of war, from capture or destruction by belligerent

erents. The greatest of sea Powers has demonstrated that the rule of the wave is no longer by force, but by trade. In 1800, British merchant vessels were manned by 140,000 seamen, while in 1803 it took 180,000 men to man the royal navy. This year's naval estimates provide for 82,000 officers and men, and the Board of Trade reports 244,000 men employed on British merchant vessels. The wars of Napoleon, of course, temporarily exaggerated the strength of the navy and diminished the importance of merchant shipping, but as the century moved toward its close the world's trading fleets have surpassed in ever-increasing ratio the world's war fleets. The two great republics are, singularly, exceptions to the rule. Second only to this change has been the adoption of a more enlightened maritime policy on the part of all nations. The century opened with Great Britain still under the Navigation Act of Cromwell, and with laws for discrimination and retaliation in force by many nations against the ships of other nations. To John Quincy Adams the world at large is indebted for the vigorous and successful assault of the young Republic upon England's navigation policy of discrimination, culminating in the treaty of 1815 and the commercial freedom of the seas.

Doubtless there are men living in whose infancy shipbuilding and navigation, so far as motive power and material of construction were concerned, had not essentially changed since the beginning of the Christian era. The substitution of steam for sail, and of iron and steel for wood, have been the century's contributions to the industry of transportation by sea. They have so revolutionised it in every phase that the facts of 1800, when put beside the facts of 1900, are instructive chiefly to the antiquarian. The following chronological table, prepared by the late Henry Fry of Quebec, at a glance gives the successive steps in this revolution:

1833—Sails to wooden paddles.
(Speed and regularity.)
1843—Wood to iron hulls.
(Strength and capacity.)
1850—Paddles to screws.
(Economy and radius.)
1856—Simple to compound engines.
(Economy, radius, and capacity.)
1879—Iron to steel hulls.
(Economy and capacity.)
1889—Single to twin screws.
(Safety and regularity.)

The dates are those when the various inventions and discoveries involved had attained such a degree of perfection as to be available in ocean navigation. Symington's little Scotch steam launch (1788), Fulton's *Clermont* (1807), and the *Savannah's* voyage across the Atlantic, mainly under sail (1819), antedated, but led to the *Comet's* voyage under steam from Pictou to Gravesend in 1833. The experimental stages of the screw propeller began with the century, and iron hulls were built in its first quarter.

By the application of steam, ocean vessels have obtained increased speed, regularity, and, consequently, greater carrying power. As a carrier, the ocean steamship to-day is reckoned at fourfold the capacity of a sailing vessel of equivalent net tonnage. The growth in volume of the world's tonnage has been moderate, judged by growth in the amount of other products of men's labour; but the capacity of the world's tonnage for carrying freight and passengers has increased over fifteenfold in a hundred years. The tonnage of 1800 (entirely sail), and of 1900 (77 per cent. steam), and the carrying potentiality of the tonnage of 1900 (sail tonnage plus net steam tonnage multiplied by four), follows, stated in thousands of tons:

	1800 (Mulhall)	1900 (Lloyd's Register)	1900 (Potentiality)
British	1,856	14,261	31,917
American	970	2,750	5,420
French	250	1,351	2,468
German	150	2,650	5,868
Norwegian[1]	70	1,641	3,935
Various	730	6,391	12,492
Total	4,026	29,044	62,100

The energy of shipping is measured by entries and clearances in the foreign trade. These rose from 128,200,000 tons in 1860 to 500,000,000 tons in 1898, and include repeated voyages with cargo and in ballast between the ports of the world. At the beginning of the century they could not have amounted to 25,000,000 tons, on the basis of the limited statistics available. To the credit of the Anglo-Saxon race, constituting a firmer link of sympathy than any treaty or alliance could forge, the greatest thoroughfare of shipping has become the North Atlantic, between the United States and the mother country. In 1800, the trade between the United States and England alone comprised 1,054 voyages, 240,564 tons; in 1899, the voyages to and from the United Kingdom were 6,060, the tonnage 14,930,000 (net). These figures throw a sidelight, too, on the magnitude of the boon which De Lessep's seventeen years of persistence and skill bestowed upon men. The voyages through the Suez Canal in 1899 numbered 3,607, the tonnage 9,896,000 (net).

The opening of the Suez Canal (November, 1869) brought Europe nearer by four thousand miles to India, China, and Japan. By permitting economical recoaling *en route*, it gave to the Asiatic and Australian trade the benefit of quick mail communication and large cargo steamships, involving great reduction in transportation

[1] Estimated.

charges. It brought Japan within the circle of modern civilisation. It established finally the screw steamship as the effective agent of ocean commerce. Before the Suez Canal, a new thoroughfare of ocean trade had been opened by the development of Australia. The entries and clearances (1895) of the Australian colonies, 6,900,000 tons, are greater than the total foreign trade of the United Kingdom when Melbourne was founded (1837). The discovery of California gold in 1847 added the last great route to the highways of shipping, and the Pacific coast of the United States, if one may prophesy, is to be the base of operations of the large steamship enterprises of the next half-century. The highest types of sailing vessels were developed by the trade around Cape Horn. The American ship *Sovereign of the Seas* made the voyage in 1851 from Honolulu to New York, 14,970 miles, in eighty-two days. To-day the world's largest cargo steamships are building for the trans-Pacific trade of the United States. Positive measures towards piercing the isthmus between the Atlantic and Pacific will begin with the dawn of the new century.

Whether shipping owes more to Watt than to Bessemer and Siemens is as yet an open question. We have had sixty years of steam navigation and probably know its possibilities and limitations. Steel ships have been built for twenty-one years, and thus far the only limit in sight to the size of the hulls of that material seems to be the depth and width of harbour entrances. MacPherson reports "965 vessels, measuring 126,268 tuns," built in British possessions in 1800; during 1899 Lloyd's states that 726 vessels of 1,416,791 tons (excluding warships) were launched in the United Kingdom. The first iron ocean steamship, *Great Britain* (1843), was 2984 gross tons. To-day 980 ocean steel steamships, each more than 4000 gross tons, conduct nearly one fourth of the world's sea-borne commerce. The two largest steamships of

1890 were 10,600 gross tons. The United States, Great Britain, and Germany, within twenty months will launch steamships of 20,000 gross tons. The *Great Eastern*, 20,152 gross tons, costing $5,000,000, launched in 1858, was a mechanical *tour de force* and a commercial impossibility, contributing to the world's welfare and progress only as a cable-ship.

In benefit to mankind, large vessels must rank above fast vessels, and in the nineteenth century the inventors of processes dealing economically with steel in great masses are entitled to place corresponding with that of the great discoverers of the fifteenth and sixteenth centuries. Large steamers have reduced freights and fares, and where shipping a hundred years ago was mainly the purveyor of luxuries to the rich and well-to-do, its function now is to serve the necessities and provide the comforts of the labouring millions of all nations. Coal alone, with its indefinite possibilities of good to men, constitutes more than one fourth in weight of the world's ocean freights.

The ocean freight on a ton of wheat from New York to Liverpool in 1868 was $5.75, in 1884, $3, and in the last three years at times it has been as low as $1.90. Passengers and immigrants arriving in the United States in 1840 numbered 84,000, and in 1882, when immigration was at its height, 869,000. The passenger fare on the steamship *Great Western* in 1838 from New York to Bristol, fifteen days, was $150. With greater comfort and security and more luxury one crosses the Atlantic now in eight days for even $30.

The functions of fast steamships are limited, and though each hour by which the trans-Atlantic record is reduced testifies to a more complete mastery of the science of mechanics and to the opulence of rival steamship companies and their patrons, the saving of time, except for mail purposes, is only one of the luxuries of

modern civilisation. The various stages by which the time of the trans-Atlantic voyage has been reduced from eleven days four hours to five days seven hours thirty-eight minutes within sixty years are indicated by the following table of representative steamships, speeds, and sizes:

Year	Steamship	Knots	Gross tons
1840	*Acadia*	9	1,155
1848	*Canada*	10.5	1,825
1850	*Atlantic*	12	2,860
1862	*Scotia*	13	3,870
1871	*Adriatic*	15	3,888
1880	*City of Rome*	17	8,144
1891	*New York*	20.7	10,600
1893	*Campania*	22	12,950
1897	*Kaiser Wilhelm der Grosse*	22.62	14,349
1900	*Deutschland*	23.36	15,500

The world's substantial gain from the improvements in marine engines and machinery is to be reckoned not from these peaks of speed, but from the extensions of those improvements throughout all levels of steam shipping. The average cargo steamer of the " tramp " class is now usually capable of the speed of the " greyhound " of 1840, and at present 1109 steamships of 5,200,000 gross tons, one fourth of the world's ocean steam shipping, have the speed of twelve knots or over. To attain or slightly increase twelve knots, before the Civil War, the American and British Governments, with liberal subsidies, pitted the Collins against the Cunard Line.

The radius of action of a steamship depends upon coal capacity; and the change from simple to compound engines, followed by that from compound to triple expansion and to quadruple expansion, both reduced the cost of operating steamships and greatly extended the trades open to their profitable employment. As late as 1858, Anderson's *Cyclopædia of Navigation* predicted:

"The improved class of sailing ships has little to fear from the competition of steamers in all the more distant branches of trade." The amount of coal required to produce steam fifty years ago permitted only a small cargo, and restricted to short voyages or forced to expensive recoaling the steamship of the day. To develop each indicated horse-power per hour in the earliest Cunarders, with simple engines, required 4.7 pounds of coal; with compound engines in 1874 the coal needed to produce the same result was reduced to 2.2 pounds, and in 1900 the *Deutschland* developed the enormous total of 37,000 horse-power, with quadruple expansion engines, on 1.45 pounds of coal per indicated horse-power per hour. More effectual combustion and decreased coal consumption in proportion to power have reduced the volume of labour and wages in the stoke-hole, the principal labour item in modern ocean transportation. The efficiency of labour on shipboard has, in fact, increased about tenfold. In 1800, for every 1000 tons of British merchant shipping seventy-five seamen were required. In 1900, only twenty-six men were required for every 1000 tons, and the carrying power of that tonnage, as already indicated, is nearly fourfold greater.

By the introduction of twin screws and water-tight bulkheads, of searchlights and international rules to prevent collisions, the perils of the sea, at least to passenger ships, have been reduced to those thus far inseparable from fog. Lloyd's reported the loss during 1899 of only 253 vessels, chiefly freight, or less than one in 100 of the world's ocean vessels. One of the greatest losses of life on shipboard in some years occurred at the Hoboken wharves.

The gross earnings for 1899 of the world's ocean shipping, steam and sail, are estimated at $700,000,000, about equal to the gross earnings for that year of the sixteen largest railroad corporations of the United States. Of

that sum $592,000,000 are estimated for ocean freights, $80,000,000 for passengers, $22,000,000 for ocean mails, and the remaining $6,000,000 for subsidies apart from ocean mails. The employment of about 1,000,000 tons of steamships by Great Britain to carry troops to South Africa increased the passenger movement above normal.

The great improvements in the instruments of ocean commerce have been accompanied by a more precise commercial organisation of the industries of ship-building and ship-owning. The master of one hundred years ago was not infrequently the designer of his own vessel, and usually, in part at least, the exporter and importer of the cargoes it carried. To-day thirty of the world's ship-building plants produce 60 per cent. of the annual product of steel steamships. Thirty steamship corporations conduct one fourth of the world's foreign trade by sea. Large shipping corporations existed, of course, long before this last century. The Dutch East India Company early in the seventeenth century had 200 ships in trade with China and Japan alone, and, in 1800, the British East India Company had 122 ships, of 106,000 tons, in trade between London and the East. These corporations, however, were monopolies created by the state.

The vastly greater steamship corporations of to-day are the product of the highest order of commercial intelligence, addressed to transportation problems, and so subdividing all the forces at command as to secure from skill, experience, manual labour, and money the maximum amount of work of which each is capable in the shortest time. With the inventors and engineers who have developed the material of the merchant marine are also entitled to be placed Samuel Cunard, C. P. Huntington, H. H. Meier,—to name types of the men who have given commercial direction to steamship enterprises.

The saving of time and money through faster and larger vessels has been possible only by improved terminal

facilities, including railroad connections. The length, breadth, and depth of the first Pacific mail steamship between New York and San Francisco, the *California* (1848), were 199 x 33 x 20. The dimensions of the first *Oceanic* (1870) were 420 x 42 x 31. The largest steamship afloat, the *Oceanic* of 1900, measures 685 x 68 x 44. (Sir Isaac Newton estimated the dimensions of Noah's Ark at 516 x 85 x 56.)? The greater dimensions of ships have necessitated longer wharves and dry-docks, deeper, broader, and straighter entrances to harbours. Work is now in progress in eighty of the world's principal seaports to increase the average high-water depth of entrance channels from 31 feet to 32.2 feet. The Suez Canal, built 26 feet deep, has been gradually deepened to 29.5 feet.

The prompt dispatch of a steamship carrying 600 carloads of grain requires large elevators. The increase in our cotton exports from 167,000,000 pounds in 1825 to 3,773,000,000 pounds in 1899 has been possible only through the effective combination of steamships and railroads where they meet at tide-water. German state railroads have been a potent means of promoting German shipping. The British railroads by their own steamships project their lines to Ireland and France, and close relations between railroads and steamships have been established in the United States. It is along the line of more intimate alliance of these interests that ocean transportation will probably develop.

The nineteenth century left Great Britain, as it found her, the predominant maritime Power, and with the present possession of one half the effective sea-going tonnage of the world, such, of necessity, she must continue to be for some years to come. For the first sixty years the progress of American shipping was so rapid that, aided somewhat by the Crimean War, the United States in 1860 contended on almost even

terms with Great Britain for the ocean carrying trade. The Civil War and the development of our internal resources, in which the coasting trade must be included, joined with causes which, of late years, have been the subject of political controversy, abruptly checked our maritime growth, and during the last thirty years we have so far ceased to be a factor in the ocean trade that our merchant flag is unknown to the Suez Canal and is a rarity in Continental ports. Germany's masterly industrial organisation and aggressive ambition during fifteen years out of her brief existence as an empire have already secured for her the second rank on the seas, and in the magnitude of individual maritime enterprises the first rank. The two great German steamship lines about a year hence will, combined, have an ocean tonnage in carrying power virtually equal to that of the world in 1800. National generosity, unscientifically applied for some years, has not enabled France to retain third rank. The signal success of this generation has been Norway's. With scant resources outside of industry, frugality, sobriety, and inborn love of the sea, the Norwegians, within the limits of the freight trade, to which they have devoted themselves, have won unsung triumphs, surpassing the exploits of the Vikings.

The growth of corporations, however, has somewhat diminished the significance of the flag. While national ownership is generally a condition to the use of the flag, modern international movements of capital have in numerous instances given the pecuniary interest in shipping to the citizens or subjects of another Power than that whose flag and register are used. Thus, until a few years ago, American capital owned the two most powerful British auxiliary cruisers, and during our late war one of the choicest Spanish prizes taken by our navy was, in fact, owned by not unfriendly British subjects, with a cargo from our own ports.

In the maritime news of the *Evening Post* for November 16, 1801, were announced the entries of the ships *Commerce* from Hamburg, 53 days; *Eagle*, from Dublin, 55 days; *Alleghany*, from Liverpool, 63 days. In November, 1900, the citizen of New York could embark on a steamship, and, in less time than the shortest of those three voyages, could reach by sea the uttermost port of civilisation. Manila, Sydney, Honolulu, Yokohama, Cape Town, Valparaiso, are as near as London was then. Through the progress of merchant shipping ocean areas have been reduced, as it were, to one third the vast stretches upon which the beginning of the century looked forth. The gain to civilisation and to the brotherhood of man has been immeasurable.

RAILROAD ECONOMY IN THE NINETEENTH CENTURY

By Arthur T. Hadley

THE history of the railroad is almost coincident in time with the nineteenth century itself; for although rails had been laid in coal mines for a long time previous, the first railroad intended for general traffic was chartered in 1800. This was a line from Wandsworth to Croydon, in the suburbs of London, and was operated by horses. During the years which immediately followed, a number of similar lines were constructed in different parts of England.

The first step toward the use of steam instead of horse-power was made in 1814 by the discovery that cars could be propelled by the adhesion of a smooth wheel to a smooth rail. Inventors at once set themselves to work on the problem of generating the power to move such a wheel in a locomotive engine. For this purpose two things were needed,— a very hot fire and a large heating surface. The invention of the tubular boiler provided the latter; the use of an escape-steam blast to secure a strong draught provided the former. The combination of the two by George Stephenson produced the modern locomotive, complete in all its essential features.

The first actual use of the locomotive was on the Stockton and Darlington Railway in 1825. It was first applied on a large scale as a motive power for handling general traffic on the Liverpool and Manchester Railway five years later. America was quick to follow the example

of England in its use. The Baltimore and Ohio Railroad, chartered in 1827, opened in 1830, after brief experiments with horse-power and even with sails, soon chose steam as the best motive power. Steam railroads were built almost simultaneously in the neighbourhood of Boston, in the coal regions of Pennsylvania, in the neighbourhood of Albany, and in South Carolina. All through the early years of railroad enterprise there was active emulation between England and the United States as to which country should equip itself most rapidly with railroads. The developments of the electric telegraph a few years later greatly increased the efficiency and safety of railroad running, and gave a new impetus to the growth of the industry.

In matters of invention which concerned the permanent way, England took the lead. Her abundance of capital, her density of traffic, and the habits of solid construction in which her engineers had been trained caused the English track to be speedily brought to a high standard of excellence. The location was arranged to avoid grade-crossings; the block-signal system was developed in such a manner as to give safeguard against collisions. A little later the system of interlocking points and signals provided a similar safeguard against derailments. It was many years before the United States could even approximate its practice to the English standards in this respect. The American traffic was so sparse that many of them were unnecessary. The capital for building American railroads was so scarce that if rigid requirements in this respect had been insisted upon, we should have waited many years before we could have built them at all. To offset our deficiency in this respect, we developed a superior system of equipment. To make up for the irregularities of the track, a system of locomotive building was adopted which, without sacrifice of strength, gave greater flexibility and power to bear shocks. To

make up for the greater liability to collisions and other train accidents, a system of car construction was devised with a longitudinal instead of a transverse arrangement of beams, which rendered these accidents far less disastrous when they occurred. Brake power was always more liberally used in the United States than in England; and about 1870 the invention of the air-brake gave the engineer a power of control over his train vastly superior to anything which had previously existed.

The results obtained in the matter of railroad speed were for a long time not so great as the inventors of the locomotive had confidently predicted. A rate of sixty miles an hour was reached at a very early period in railroad enterprise. Beyond that, each successive increment of speed has been attended with great difficulty. For a long time nearly all the rapid running of trains was done in England, the standard of track and equipment in other countries being hardly sufficient to admit of good results in this respect. As late as 1888, a careful statistical investigation showed that the daily mileage of trains running faster than forty miles an hour including stops was about sixty-three thousand in England, about fourteen thousand in the United States, and very small indeed in the rest of the world. Since that time there has been so much gain in American roadbeds that a similar comparison at the present day would probably show the two countries on a footing of substantial equality in this respect. The most rapid *regular* performances for long distances—two hundred miles and over—are at rates of from fifty to fifty-five miles an hour. For short distances we find schedules arranged at rates of above sixty miles an hour, while there are individual records running as high as ninety and one hundred. At a point a little above the latter figure we seem to reach the physical limit of speed except on a down grade; the figures of fifty and sixty miles represent the operating limit of what is

practicable and profitable under the most favourable conditions. What will be the effect of the introduction of electric motors upon train speed it is as yet too early to say.

But in all other respects except speed the railroad has far exceeded the expectations of its most sanguine advocates. To the variety of service to which it can be adapted, and to the amount of traffic which it can handle economically, there scarcely seems to be a limit. When railroads were first built it was supposed that they could be used only on level ground and for thickly settled communities. In actual experience it has been found possible to increase the gradients which can be overcome and to build mountain railroads which give access to places that could not be commercially reached by waggons. There is no space in an article like this to enumerate the feats of engineering by which successive railroads have crossed or pierced the Alps, the Rocky Mountains, or the Cordilleras. Where a line of ordinary gauge cannot run, a narrow-gauge road is often possible. Not that narrow-gauge roads have had the economic importance which was anticipated at the time of their first development from 1870 to 1880. As a matter of commercial economy, the expense of operating a narrow-gauge road outweighs the gain in cheapness of first cost. In general, a narrow-gauge railroad cannot be run in competition with a standard-gauge line which handles the same traffic; but where the standard-gauge line cannot go at all the narrow-gauge line extends the sphere of railroad influence. Still steeper gradients can be overcome by the use of the rack and pinion, which brings almost every mountain summit within the possible reach of the railroad engineer.

Instead of following in the wake of trade, railroads have become its pioneers. In countries like the United States, where there is unoccupied land, the system of land grants has made railroads a means of settlement of

new territory. In countries desirous of extending the sphere of their political influence, the building of railroads in advance of commercial necessity becomes a means of strategic power. This political and semi-military use of railroads was first perceived by Prussia about 1850, when the construction of a line from Berlin towards the Russian frontier laid the foundation at once of the state railroad system of that country, and of its subsequent ascendancy in German politics. Similar political and military ideas underlay the great efforts made in the time of the Civil War to push to its completion the Union and Central Pacific Railroad line, connecting two parts of the country which had previously been isolated from one another. The same cause is responsible for much of the rapid railway development in the Dominion of Canada, and still more so for that in British India. But nowhere has it been so strongly exemplified as in the modern history of Russia. The Trans-Caspian Railroad, begun in 1881, and substantially completed in 1886, running from the south-eastern corner of the Caspian Sea into the very heart of what was once marked on our maps as Independent Tartary, has made Russian influence dominant in a part of the world where twenty years earlier a white man could hardly penetrate, and has rendered it possible to bring the Russian army at any time within striking distance of the north-western frontier of British India. But this achievement has been recently thrown into the shade by the virtual completion of the Trans-Siberian Railroad, extending in a practically continuous line from the Ural Mountains to the Pacific Ocean, and placing Russia within reach of the theatre of Asiatic conflict as no other European nation can place herself.

But more surprising even than the history of railroad construction has been the development of railroad operation, and particularly the success in cheap handling of

freight. When railroads were first built it was supposed that they would find their chief use as carriers of passengers. Their freight business was expected to be at best an incidental thing—a local express business on a somewhat larger scale than had previously been possible. That railroads should handle long-distance traffic, that they should create new industries, or that they should compete effectively with water routes was not expected by anybody. It was about 1850 that the possibilities of large freight handling first dawned upon railroad managers. The competition of the New York Central Railroad with the Erie Canal aroused not only surprise, but severe criticism. Mass-meetings were held to insist on the passage of laws which should stifle such competition. We were told that the canal had a natural right to all heavy freight; that it was suicidal folly for the railroads to try to carry it, and that their managers in so doing were ruining themselves and the stockholders whom they represented. But that which awakened surprise in 1855 was accepted as a matter of course in 1870. The canals were compelled to abolish their tolls in order to meet the competition of the railroads. The rates which seemed suicidal in 1850 or 1860 were reduced again and again; until now the trunk-line freight-rate for heavy goods is less than a sixth of what it was at the time when the competition began. A similar cheapening of freight transportation has made itself felt in other countries, notably Russia and British India, though not to the same degree as in the United States.

It is interesting to study the means by which this cheapening has been accomplished. First in order of time was the recognition of the economy of handling freight for long distances as compared with short ones. So large a part of the expense of railroad transportation is connected with loading and unloading, rather than with the actual haul, that the cost of service does not

increase in proportion to the distance. In fact, where freight for long hauls can be obtained with regularity, the actual expense of dealing with it may be less than that of local freight at intermediate points. But a yet more important means of cheapening is found in the series of improvements which made it possible to handle goods in larger bulk. An increase in the size of the cars increases their dead weight but slightly, and increases very greatly the quantity of goods which they can safely carry. This change began about 1870, at the time when the introduction of steel rails and the use of stronger bridges rendered heavier loading safe for the track. It has reached its highest stage of development only in these last years, with the increased use of steel in the construction of the cars themselves. A further advantage was obtained by the increase of size of locomotives. The "American" locomotive, with its two drivers on each side, has given place for freight handling to the "Mogul" with three drivers, and the "Consolidation" with four. This has increased the weight of the locomotive something like fifty per cent; it has increased the load which they can draw three-, four-, and even fivefold. Finally, improvements in the track itself have enabled the new cars and new engines to be utilised with the utmost operating economy, and have made it possible, with a given amount of fuel and train-service expense, to accomplish in actual hauling ten times the amount which was possible a generation ago.

The result of this has been the gradual lowering of rates per ton per mile on the railroads of the United States from more than three cents at the close of the war to three quarters of a cent at the present day. But this cheapening has not been unattended with evil. It has given the railroads power to create traffic when they pleased and where they pleased, and by so doing to put the shippers who were not favoured at the mercy of the

railroad authorities. In other words, it has put in the hands of the freight agents a power of discrimination which would enable them to build up one locality or one individual at the expense of another. The danger from the abuse of this power has brought into the forefront of economic discussion the question of the relations between the railroads and the Government.

In the years immediately succeeding the Civil War, when discrimination was a new thing, it was exercised in the most arbitrary manner. As a natural reaction against such abuse of power, the " Granger " laws were passed in the States of the upper Mississippi Valley, which attempted to fix rigidly the rates which the railroads were allowed to charge. These laws defeated their own purposes. By arbitrarily lowering the rates on all traffic to the level of that which was handled with exceptional advantage, they left the companies no money to pay interest. The construction of new lines was thereby checked, and the development of the whole State suffered from this stoppage. By ten years' experience both sides had learned something; and when, about 1880, the movement was started which led to the passage of the Interstate Commerce Law, the railroads had become already less arbitrary in their charges, and the legislators less exacting in their demands. The railroads had endeavoured to stop some of their more serious discriminations by means of a pooling system which should do away with that severe competition at large points of shipment whereby these places obtained the benefit of lower rates. The legislators agreed with the railroads in recognising that discrimination was the main evil to be stopped, but they distrusted the railroad remedy, because they believed that pools would be used to level rates up instead of levelling them down. The Interstate Commerce Law, finally adopted in 1887, was framed under the influence of these views. It was a far more moderate

measure than any of the "Granger" laws; but its provisions, and especially the prohibition of pools, contained in this law, and in the Anti-Trust Law, which was passed immediately afterward, had to some degree the effect of limiting railroad profits and thereby for many years lessening the construction of new lines.

England has witnessed during the same closing years of the century legislation similar in intent to the Interstate Commerce Law, though less definite in its results. The majority of countries, however, have not been content with limiting by legislation the arbitrary action on the part of railroad managers, but have insisted that a power of this kind could properly be placed only in the hands of agents of the Government. In other words, they have committed themselves in a greater or lesser degree to the principle of state railroad-ownership. This was in one sense no new thing. Belgium had from the first had state railroads, because the King of the Belgians, at the time of the first development of the railroad, was anxious that his country should enjoy the benefit of the new method of transportation, before private enterprise was ready to take it up. Ever since 1850, Prussia had had a very considerable state railroad system, originally undertaken for strategic purposes. But it was not until after the war of 1870, in connection with the increased national feeling which arose, that railroads were taken by governments as a means of strengthening governmental power over the life of the nation. In the decade which succeeded the war of 1870, all the more important Continental countries, with the exception of France, greatly increased the hold which they had upon their railroads. The system of state ownership was already triumphant throughout Australia and powerful in British India. But in the light of actual experience it is seen that the results of government ownership in the matter of railroad economy and operation are not greatly different from those of

private ownership. There are nearly the same possibilities of good management, and the same evil possibilities of bad management, whichever system is chosen. If we have a little more chance of irregularity under private management, this is balanced by an increased chance of inefficiency under government management. Much is made of comparative statistics by the advocates of one system or the other, but it is generally found on critical examination that these statistics prove far less than seems plausible on their face. The advocate of private ownership points to the fact that the freight rates per ton per mile in the United States are the lowest in the world; but his opponent can show that freight in the United States is handled in the largest masses and for the longest distances, and that in point of fact the freight rates of different countries vary in proportion to the average length of haul, whether the roads of those countries be owned by the Government or by private corporations. The advocate of state ownership points to the low passenger rates in certain parts of Europe as compared with the much higher ones in England or the United States. But it can be shown, on the other side, that the high passenger rates are paid for having fast trains and for having trains numerous in proportion to the population which they serve. The high or low passenger rates of different countries depend, not upon private ownership nor upon state ownership, but upon the average rate of wages per day received by the bulk of the population. If a man has high wages, he can pay money to save time; if he earns relatively low wages, he can sacrifice time to save money. In the former case the railroads will pay their train expenses by carrying relatively small loads at high speed; in the latter, by having few trains which carry large numbers of passengers very slowly.

Instead of arguing on the relative merits of state ownership or private ownership, the students of railroad econ-

omy at the present day recognise that the decision of this question depends upon the industrial habits and traditions of different peoples. That system is the better which gives the best chance of securing efficient managers for the railroads, and of holding those managers responsible for using their power in the public interest. When the civil service is good and private business methods slack, there is reason for state ownership. When the civil service is less good and private business methods better, the best results may be expected from ownership and management by private companies.

EQUIPMENT, ORGANISATION, AND OPERATION OF RAILROADS

By J. W. Midgeley

THE revolution wrought by steam as a means of transportation can best be measured by contrast with the method it superseded. It was an advance when the mail-coach came into use in England. Previously, the mails had been carried in carts or by post-boys; while journeys were accomplished in private conveyances, on horseback, or on foot. The mail-coach soon became popular, and there speedily grew up in Europe and this country a regular system of transportation by stage-coaches and heavier vehicles; and, in improving character, as highways became safer, those agencies flourished until the advent of the steam engine, in 1830. As for the speed and charges that were incident to transportation by mail-coach and waggon, eight, ten, and twelve miles an hour were the maximum speed, and, between London and Edinburgh, outside passengers were charged £10, inside £14, and the trip occupied forty hours. The same journey is now made in eight hours at a cost of about $7.50. Manifestly, only the wealthy could afford to travel in coaches. Others had recourse to waggons. Merchandise was carried in slow-going vehicles, and some idea of the cost may be derived from the tariff,—namely, $10 per ton for the thirty miles between Manchester and Liverpool. Compare that with the present situation at Pittsburg, whose manufacturers complain when required to pay $3.60 per ton for the transportation

of finished products to Chicago,—a distance of 468 miles.

Interesting to the student will always be reproductions of the earliest passenger trains. The occupants were exposed to the elements — their sole protection being an awning suspended overhead. Only a few passengers were provided with seats. The vehicles resembled a platform car, with sides three or four feet in height. Wooden roofs were afterwards adopted, whereon the baggage of passengers was piled, and on those were also seated the guards. Each carriage was given a name, as stage-coaches had been, and as sleeping-, parlour, and private cars are now. The pictures further represent the gentry riding in their family carriages, which were lifted upon trucks without removing the wheels. Originally the railroad was regarded as an improved highway, whereon the public, on payment of toll, could run their own conveyances.

Still more marvellous is the transformation that has been effected in the locomotive. We look with wonderment upon the modern machine,—than which there is no greater triumph of mechanical skill,—but the day of small things, when the " Rocket " and its compeers awed and amazed their beholders, ought not to be forgtten. Majestic as the upward march has been, the highest recognition will be given to the master mind that indicated the way. More, however, in utility than in form, has the standard locomotive progressed. Speaking of the first engine built by the Baldwin works, the Philadelphia *Chronicle* exultantly said: " This engine will draw thirty tons on a level road." But proud as its owners were of its strength, they were loth to expose it to trial, as witness the following advertisement taken from a Philadelphia paper of that day:

" Notice.—The locomotive engine (built by Mr. W. Baldwin

of this city) will depart daily when the weather is fair with a train of passengers; on rainy days horses will be attached."

Over the intervening period we may pass to the year 1885, when the Baldwin works began to construct "decapods," that is, engines with ten wheels coupled, which were guaranteed to haul 3600 tons of freight on a level track. Five years later, the same company built locomotives that could haul 4000 tons on an ordinary track, which exceeds the burden of an average ocean liner. Meanwhile, mechanics have steadily sought to increase the carrying capacity yet not augment the dead weight per train. With that view, bridges were strengthened, heavier rails laid, and larger cars built, until the latter rose to 30,000 pounds each, then to 40,000, 50,000, 60,000, 80,000, and 100,000 pounds, which last weight is the capacity of pressed-steel hopper cars of the year 1900. Necessarily, to move a train of twenty-five or thirty such loaded cars, locomotives of a strength truly Titanic are required; and these are being as readily constructed as were the light machines of thirty years ago.

Opportunity and experience have been the school of railroad men. Not often have the leaders possessed more than an elementary education. The most successful have been those who rose from the lowest positions. Quite early, associations were formed that met in annual conventions, such as the Master Mechanics, Master Car-Builders, Road-Masters, Train-Masters, Conductors, General Ticket Agents, Car Accountants, General Baggage Agents, etc. The object was to compare methods, exchange experiences, test new propositions, promote uniformity, and establish standards. In effect, these organisations were summer schools, and by the appointment of committees to investigate and report at subsequent meetings, progress was steadily made and the railroad service was improved. Instead of each company

being a law unto itself, rules adopted in convention became the standard. Technical journals were approved by the associations, so that the progress of education was constant, and a higher degree of knowledge and skill was acquired by American employees than characterises the railroad profession in other countries. The executive officers likewise met regularly; in fact, every important department availed itself of such opportunity to gain information. To this blending of theory, experiment, and practice, and a general willingness to receive and impart instruction, the unique excellence which has been attained must largely be attributed.

There was no luxury and little comfort in railroad travel when George M. Pullman began his experiments. To him the public is indebted for the palace sleeping-car, whereby a trip across the continent can be performed without discomfort; for the parlour coach, in which a day's journey is accomplished with ease; and for the dining-car, wherein meals are served in quality and style not inferior to those of the best hotels. Ordinary coaches have also been so improved, lighted, and furnished, that the longest ride in them is luxurious compared with that of a generation ago. So marked were the advantages afforded by special cars that the public speedily recognised them, thus compelling their adoption, in one form or another, by all through lines. Notwithstanding those added facilities, it is possible now to travel from New York to San Francisco, in through cars sumptuously appointed, for a less sum than was formerly charged for a passage-ticket from ocean to ocean.

Railroads were chartered as common carriers, not as forwarders; hence, as conceived and for many years conducted, the duties of the companies ceased when the end of their rails was reached. Thus there grew up in the early days a class of forwarders at terminal points, who undertook to transfer goods from one railroad to another,

and arrange for the forwarding of the same to destination. Shippers had to bear the expense of such intermediate service, through their own agencies, or by contracting with others for its performance. The adoption of through bills of lading — a voluntary act on the part of carriers — saved to shippers an infinite amount of trouble and no little expense. This result was not attainable until after certain loose links had been united. For example, half a dozen different companies, separately owned and operated, constituted the present New York Central route from New York to Buffalo. Much greater consolidations have since taken place, hence we are apt to underrate the initial undertaking; but its importance, because of the possibilities it revealed, entitles it to the first place in that line of performances.

The policy thus pursued was speedily followed in this country and Great Britain. The influence at which men marvelled when it was projected from New York to Buffalo, was extended, *via* the Lake Shore and Michigan Southern Railway, to Chicago, the North-Western to Omaha, and *via* the Union Pacific three fourths of the way across the continent; for, while Commodore Vanderbilt was President of the New York Central and Hudson River Railroad, his son-in-law, Horace F. Clark, became President of the Lake Shore and Michigan Southern and the Union Pacific Railway Companies.

The tendency to combine, which spread with amazing rapidity, alarmed the public in English-speaking countries; and legislative committees were appointed to devise remedies for the alleged evil. Voluminous reports were issued and various preventives suggested, the noticeable one being the adoption, by certain States, of Constitutional amendments forbidding the consolidation of parallel or competing lines. As there could be no effective way of estopping persons from controlling all they were able to buy, the process went on,— the

difference being, that instead of operating the properties under one name and management, their separate identity was maintained; but the directory in each instance was practically alike. Eventually, the interests of a few have to yield to the good of the many, and as by the union of independent lines into through routes, the service to the public was improved and cheapened, the new order gained favour, especially as without it commerce could not, in its present extent and rivalry, be successfully conducted.

Next in importance to the through bill of lading and unbroken transportation from initial point to destination are the approaches that have been made to unify the freight classifications. In the beginning, each carrier established its own rules. Of course, it was early seen that expensive goods, such as silks, cloths, and like valuable articles, would readily carry higher rates than would coal, iron, grain, or coarse commodities; consequently the former were placed in the first class; and according to the lesser risk involved, or the better loading, the commoner goods were given lower ratings. Usually rates were adjusted on a mileage basis, the rate declining with the distance; but as parallel and cross routes were built and competition became keen the tariffs had to be revised to meet changing conditions. Competitive points were favoured, and this led to a mania for railroad construction. Aid was voted by municipalities, land grants and subsidies were offered by States and the nation, the result being that without much regard to other than local demands the present network of railroads sprang into existence. As already stated, at the initial stage each company made its own classification and tariff. For a time those were quite simple, frequently being expressed on a single sheet. The progress made in this respect has been accomplished within the last quarter of the century.

It would now look ridiculous were a dealer to be

charged fourth-class rates for a shipment from A to B, and then be required to pay third-class for the return of the goods over the same route from B to A; yet such inconsistencies were regular occurrences. Not until the adoption of the Interstate Commerce Law (in 1887) was the classification in use by the trunk lines and their connections made to apply in either direction. Previous thereto, there were separate west-bound and east-bound classifications. The railroads operating in the territory west of Chicago and St. Louis had, several years before, made that important advance.

The Trunk Line Association was then directed by Col. Albert Fink, and the organisation of Western railroads by the writer. The west-bound tonnage was, by the lines from the seaboard, divided into four classes, while that of the Western roads was distributed among five numbered and at least three lettered classes. All after the first four were exclusively car-load classes. To facilitate the division of west-bound tonnage between the trunk lines, Col. Fink desired to reduce the number of classes to three. At that juncture a conference was arranged at Niagara Falls between the trunk lines and Western roads; but their differences could not be reconciled. The trunk lines wished to abrogate all car-load rates, whereas the Western people, being close to the manufacturers, wanted to swell the number of car-load classes. The Eastern parties withdrew, but the others remained and evolved what became known as the Western classification. It was substituted for numerous classifications, and within a short time governed in the territory west of Chicago and St. Louis to the Pacific coast.

While it required much persistence to achieve this result, the satisfaction with which it was ultimately regarded prompted the writer (after the Interstate Commerce Law had become effective and Eastern railroads

had adopted one classification the "Official,") to apply in both directions east of the Mississippi and north of the Ohio, to try to unify the leading classifications then in use. In addition to the Official and the Western there was the Southern, in the territory south of the Ohio and east of the Mississippi Rivers. Accordingly, another conference was called at Niagara Falls. The result was the appointment of a committee, consisting of delegates from important sections of the United States; but the same fate attended this effort as the previous one between Eastern and Western railroads—an inability to to agree upon the number of classes.

Meanwhile, the Interstate Commerce Commission viewed with anxiety this failure of the railroads to agree; and the passage by the House of Representatives of a joint resolution calling upon the Commission to formulate a uniform freight classification, provided the railroads did not undertake the work within a specified time, justified the Chairman (Judge Cooley) in urging the writer to renew his efforts lest the Commission be required to perform the task. The outcome was the creation of a second committee, containing no representatives from the Pacific coast, but including one from Canada, thus imparting an international character to the deliberations. This body met, and its work, taken up at intervals of three months amid the press of other duties, continued over two years, when a unanimous report was made to the constituent organisations. To the latter the uniform classification was acceptable, with the exception of two trunk lines. By those its adoption was defeated, and the earnest labours of the committee, the devout wishes of countless shippers, and of the majority of American railroads were thwarted. Annually since then the Interstate Commerce Commission urges Congress to compel the adoption of uniformity in freight classification; but though its practicability was demonstrated, and it is more

earnestly desired by the commercial community than is any other reform, its outlook is not so promising as it was ten years ago. No one in active service has the influence apparently to command the renewed co-operation of the railroads; and as the members of the Interstate Commerce Commission are not traffic experts, the prospect of their performing the task is not inspiring.

Another reform which preceded the efforts to unify the freight classification should be noted,— namely, the extension, to all classes, of rates per one hundred pounds, and the inspection of packages to prevent misdescriptions. During the writer's early career as Commissioner for the Western railroads, all freight classified below fifth class was carried at stated car-load rates. No attempt was made to ascertain the actual weight put in the cars. It was true that freight tariffs usually contained an instruction to agents to require the removal of all in excess of 24,000 pounds per car; but the rule was rarely enforced for the reason that track-scales were comparatively unknown. The abuses that were practised led to frequent complaints by the more scrupulous, and as a remedial experiment certain Western railroads resolved to charge for the transportation of lumber by the one hundred pounds. This worked so well that the rule was extended to classes A, B, and C freight; and as much of this originated with Eastern connections, the writer induced them to amend their tariffs. A conference of railroads in the Middle States was convened in Cleveland, at which car-load rates were eliminated from their tariffs and rates per one hundred pounds were substituted, and have since prevailed throughout the United States. Track-scales were put in at convenient points, freight cars were weighed, loaded and light, or, when not practicable to do the former, the stencilled tare weight of the car was deducted from the gross. Weighers were appointed by the Commissioner and paid through his office, to avoid collusion and satisfy

competitors that equality of treatment would be insured. This reform saved millions of dollars yearly to the railroads of the United States; in fact, it is not apparent how they could operate under a different condition. To return to former methods would bankrupt many railroads, would throw the business of the country into confusion, and inflict irreparable loss upon interests that are prosperous.

None of the changes described could have been accomplished without organisation. No railroad can afford to lead in a reform; therefore it is not wise to pass judgment hastily upon organisations through means of which much has been accomplished. Suffice it to say that if there were now a strong association of railroads — such as the Railway Clearing-House of England, which is incorporated by Parliament — shippers would soon have what they most ardently crave,—uniformity in freight classification, or at least the removal of disparities that reflect on the intelligence of traffic managers who can neither explain nor justify their continuance. The United States Supreme Court decided in the trans-Missouri case (March, 1897) that associations of railroads formed to maintain rates were in contravention of the Anti-Trust Law. So long as a right they had considered inalienable is denied them, the companies seem unwilling to join in the establishment of better relations. Thus the century closed with the deadlock between Congress and the carriers unbroken.

Strangely enough, the United States, which is ahead of other countries in the character of and service rendered by its railroads, is behind them in its political attitude toward corporations. In that respect, Mexico has distanced us. Complete accord prevails there between the Government and the railroads. The authority of the former is unquestioned, and its right to fix maximum rates of fare and freight is recognised. So likewise there is no doubt

as to the power of Parliament to regulate the railroads of Great Britain. But in this country at every stage bitter opposition or veiled resistance has been encountered. Mexico completed her reconciliation with the railroads only in 1899; but every such effort in the United States, including that of the present Congress, has failed. The precise situation may be described as follows: American railroads present the finest service, the lowest rates of fare and freight, the best equipment, the latest safety appliances, and the highest order of intelligence and ability among officers and men, together with the worst discriminations, grossest violations of law, and the most shameless disregard of official honour to be found anywhere.

In its operation, the modern railroad compares favourably with the best disciplined army. Obedience and attention are most rigidly enforced. No general is more autocratic than is the typical president, and the latter is as strictly held to account. The president has subordinates, whose duties are identical with those of a general's staff. The same precision that characterises the German army is reproduced in every well-administered railroad. Those conditions have grown up gradually, until routine operations move with the smoothness of machinery. Admiration for the organisation increases with acquaintance, and we cease to wonder at the pride that railway men take in their profession, and the warmth with which they usually speak of "our road."

The principal problem that has confronted railroad managers is to insure the maintenance of remunerative rates upon the traffic carried. When the fixed charges are not met, receiverships follow. Every expedient, therefore, that would lessen the cost of operating was adopted; but the limit in that direction was thought to have been reached; and, as no device for the strict maintenance of rates has yet succeeded, the inevitable

result would have overtaken all — as it did many — a few years ago, had it not been for the ability to double and quadruple the capacity of freight-cars. It has already been explained how this was brought about. Managers feared the journals would not carry loads heavier than 24,000 pounds per car, hence penalties were threatened in case of excess loading. Bridges and trestles, it was further assumed, would not bear the heavy strain. But on weighing some of the cars that slipped through, they were found to contain 5000 and 10,000 pounds in excess of the prescribed weight, thus dispelling the illusion that the bearings, etc., were insufficient. Notwithstanding those discoveries, meetings were held to restrict the dimensions of freight-cars; but the efforts failed, and the demand for larger equipment continued until the average load per car is 100 per cent. greater than the maximum allowed twenty years ago. While the rate per ton per mile has steadily decreased until it is lower in the United States than prevails elsewhere, the average amount of paying freight per train mile has correspondingly increased, so that, with returning prosperity and an abundance of tonnage, most railroads have been able to make satisfactory showings.

Similar results were attempted prior to the passage of the Interstate Commerce Law, by the formation of "pools." Those devices were of English origin, where they were known as "joint-purse" arrangements. In that country they had a semi-legal status, the Solicitor-General having informed a Parliamentary committee that the only party to complain was a stockholder who might enjoin the payment to another company of money in which he was interested. In Mexico, pools are authorised by the railroad law of 1899; but attempts to legalise them in the United States, subject to the jurisdiction of the Interstate Commerce Commission, have invariably failed.

It has not, however, seemed that their revival is imperative. There is a community of interest on the part of owners, therefore they can delegate authority to leading bankers; and if the latter are enabled to shape the policy of the larger companies, a recurrence of "rate wars" can be avoided. Such a course has been pursued in the East, as witness the entrance into the directories of the Baltimore and Ohio, Chesapeake and Ohio, and Norfolk and Western railways of representatives of the Pennsylvania Railroad, the extension of the Vanderbilt influence to other properties, and the dominance of leading bankers in various directions. A request from the latter will have more force than would the strongest pool in restraining the zeal of ambitious agents to overreach their rivals. Hence the problem of maintaining remunerative rates is in process of solution by means which no legislation would seem able to circumvent. Where consolidations are forbidden by law, leases of the property and the operation of the latter under separate names are usually possible; and as control of the company is the result aimed at, the manner of its accomplishment is not material.

THE SCIENCE OF WAR

DEVELOPMENT OF THE NAVY

By Edgar S. Maclay

In the course of the past century the United States built five distinct fleets of war-craft, each one being such a vast improvement over its predecessor as to cause a revolution in naval architecture in all maritime Powers. It is scarcely too much to say that American shipbuilders have forced the somewhat conservative and phlegmatic naval administrations in European countries to build and rebuild their war fleets five times in the nineteenth century. As old Captain Symonds of the Royal Navy expressed it in 1777, after his ship, the *Cerberus*, had narrowly escaped destruction from a torpedo discharged by a Yankee submarine boat, "the ingenuity of these people is singular in their secret modes of mischief." It certainly is true that every innovation and improvement devised by the Americans in naval warfare was at first ridiculed and stoutly resisted by our friends across the ocean, and every imaginable mishap was predicted for those rash Americans and their "bundles of pine boards with a gridiron flag floating over them."

It was our first group of war-ships in the present century—the *Constitution*, *United States*, *President*, *Crescent*, *Constellation*, *Congress*, and *Chesapeake* — that made the first startling revolution in naval warfare, namely, the concentration of the power of a ship-of-the-line in the space of a frigate. Down to that time the line-of-battle ship was the bulldog of the high seas. No craft of lower rating would have presumed for a moment to dispute the

right of way with her. By introducing a number of improvements, and increasing the length of their frigates only twelve feet, American shipwrights produced a class of war-ships—" terrible nondescripts " the English then called them—which, though nominally and visibly much smaller than the line-of-battle ship, were superior to those huge craft in sailing qualities, and equal to them, as the British repeatedly asserted, in their fighting capacity. Our English friends declared that these new frigates were " line-of-battle ships in disguise," and sent out from Cadiz some of the largest vessels that had been under Nelson's command at Trafalgar, disguised as frigates, to meet our *Constitution.*

The principal innovation in the frigates of the *Constitution* class was that of placing 24-pounders on the main deck, and 32- and even 42-pounders on the quarter-deck and forecastle, at a time when English experts declared that only 18- and 24-pounders should be carried. About a year before the War of 1812 broke out, Captain Carden of the new British frigate *Macedonian*—then considered the finest specimen of British naval architecture afloat—happened to be in Lisbon, and dined with Captain Decatur aboard the *United States*, then at anchor in the Tagus. Carden particularly pointed out the inefficiency of the 24-pounders on the main deck of the *United States*, and said that they could not be handled with ease and rapidity in battle, and that long 18-pounders would do as much execution, and were as heavy as experience had proved that a frigate ought to carry. " Besides, Decatur," said Carden, " though your ships may be good enough, and you are a clever set of fellows, what practice have you had in war? There 's the rub." Singularly enough, these commanders, in the same ships, met in battle a year after this conversation, and the *United States* captured the *Macedonian* with almost as much ease and impunity as if the Englishman had been a sloop-of-war.

In the second class of war-craft—the sloop-of-war—that formed part of our first fleet in the nineteenth century (we then had only two main divisions in the navy), American naval architects demonstrated, in a most forcible manner, their ability to concentrate offensive and defensive qualities. Our sloops-of-war outclassed those of foreign navies at every point. Speaking of the action between the *Enterprise* and *Boxer*, September 4, 1813, the London *Times* of that year said:

> What we regret to perceive stated, and trust will be found much exaggerated, is that the *Boxer* was literally cut to pieces in rigging, sails, spars, and hull, whilst the *Enterprise*, her antagonist, was in a situation to commence a similar action immediately afterward. The fact seems to be but too clearly established that the Americans have some superior mode of firing; and we cannot be too anxiously employed in discovering to what circumstance that superiority is owing.

Another instance of unbiased testimony as to the superiority of the American-built sloop-of-war is given in Sir Edward Codrington's letter to Lady Codrington in 1814: "It seems that the *Peacock*, American sloop-of-war, has taken our *Epervier*. But the worst part of our story is that our sloop was cut to pieces and the other scarcely scratched."

One of the most intelligent officers in the Royal Navy in 1814 was Captain W. F. Wise of the frigate *Granicus*. Accidentally he captured the American privateer *Leo*, Captain George Coggeshall. In a conversation with Coggeshall, Wise said:

> You Americans are a singular people as respects seamanship and enterprise. In England we cannot build such vessels as your Baltimore clippers. We have no such models, and even if we had them they would be of no service to us, for we never could sail them as you do. We have now and then taken some of your schooners with our fast-sailing frigates.

They have sometimes caught one of them under their lee in a heavy gale of wind by outcarrying them. Then, again, we have taken a few with our boats in calm weather. We are afraid of their long masts and heavy spars, and soon cut down and reduce them to our standard. We strengthen them, put up bulkheads, etc., after which they lose their sailing qualities and are of no further service as cruising vessels. He also remarked [records Captain Coggeshall] that the famous privateer, *True Blooded Yankee*, which had done them so much mischief, once belonged to their navy; that they had captured her from the French; that she afterward was retaken, and finally got into the hands of the Americans; that she then outsailed everything, and that none of their cruisers could touch her, and concluded by adding that we were a most ingenious people.

That American naval architects revolutionised naval construction in their first fleet of war-ships in the nineteenth century is shown in the following quotation from the London *Times* of March 17, 1814: "Sir G. Collier was to sail yesterday from Portsmouth for the American station in the *Leander*, 54. This ship has been built and fitted out exactly upon the plan of the large American frigates." It was in 1820 that the British Government sent a naval expert to inspect our navy. He reported that

the organisation of the American Navy Department, either for administrative or practical work, is the best system extant. Their ships are the best built, and their timbers are unsurpassed. Their frigates are competent to cope with our ships-of-the-line [referring to a new group of frigates built after the War of 1812], and their ships-of-the-line with three-deckers; and the whole administration of the navy is conducted with comparatively little expense.

In the introduction of a new edition of James's *History of the British Navy*, the editor (a captain in the Royal Navy) says:

It is but justice, in regard to America, to mention that England has benefited by her [America's] example, and that the large class of frigates now [1826] employed in the British service are modelled after those of the United States.

In the light of such testimony there can be no question that the first group of American war-ships in the nineteenth century was superior — taking ship for ship — to any in European navies. This superiority is strikingly illustrated in a conversation that took place aboard the *Constitution* in 1815 at Boston, when that ship was fitting for a Mediterranean cruise. A distinguished English naval officer had been inspecting "Old Ironsides," and on returning to her quarter-deck remarked to the American commander:

This is one of the finest frigates, if not the very finest, I ever put my foot aboard of. But, as I must find fault, I 'll just say that your wheel is one of the clumsiest things I ever saw, and it is unworthy of the vessel.

The American captain replied:

That wheel, sir, is the only thing English in the ship. When this frigate captured the *Java*, in 1812, our wheel was knocked into splinters by a shot from your vessel. After the engagement the *Java's* wheel was fitted, and although we think it as ugly as you do we keep it as a trophy.

The development of the three classes of vessels forming our first navy in the nineteenth century reached its climax in the *Vermont*, *St. Lawrence*, and *St. Mary's* type. These vessels and their sisters, at the time they were completed, were considered the most formidable war-craft of their several ratings afloat. The successful introduction of steam as a motive power in belligerent craft, however, soon demonstrated the superiority of that style of war-ships. Steam began to assert itself in the

navies of the world about 1838, and here again we find that American naval constructors took the initiative. The first war-craft propelled by steam was the *Fulton*, or *Demologos*, built by Robert Fulton in 1813–14. She was a remarkable conception. Besides the radical innovation of steam power, her battery of twenty 32-pounders was supplemented by a submarine gun designed to discharge a 100-pound shot. She was built on two separate hulls, having her single paddle-wheel in the centre, and was fitted with engines capable of discharging immense volumes of scalding steam into an enemy's port-holes. Furthermore, the *Demologos* had a furnace for hot shot, the first ever to be successfully used in a war-ship. This remarkable craft made several trial trips, but on the cessation of hostilities with Great Britain she was laid up in the Brooklyn Navy-yard as a receiving-ship, where, in 1829, she was blown up and a large number of men were killed. It is believed that she was purposely destroyed by superstitious seamen, who objected to such "steam devils" supplanting the more comfortable sailing craft.

To Captain Matthew Galbraith Perry must be awarded the credit of being the first navy officer to urge successfully the construction of a fleet of steam cruisers for the United States Navy. It is difficult for us, in the light of to-day, to realise the prejudices that existed against the introduction of steam in war-ships. When Perry, on February 17, 1838, seriously declared it his belief that war steamers of 1500 tons could be built to cruise twenty days without disaster, he was regarded by many of his brother officers as being exceedingly visionary and eccentric. James K. Paulding, who was Secretary of the Navy in 1838, declared: "I never will consent to see our grand old ships supplanted by those new and ugly monsters." The advantages of steam, however, were too apparent to be opposed by any poetic objections, and in 1841 the side-wheel steamers *Mississippi* and *Missouri* were

launched, their construction having begun in 1839. This marked the beginning of a second distinctive fleet in the United States Navy in the past century. These "marvels of naval architecture," as they were then considered, were quickly followed by the side-wheel war-ships *Michigan*, *Water Witch*, *General Taylor*, *Vixen*, *Saranac*, *Powhatan*, *Susquehanna*, *Pulaski*, *Saginaw*, and a number of others built during the Civil War.

Perfect as these "wonderful" side-wheel war-craft seemed at that time, they were soon doomed by the propeller, which, having all its machinery below the water-line, was a great improvement over the cumbersome side-wheeler. And here, again, American naval constructors have a well-grounded claim for priority. It was Ericsson who, in the spring of 1837, under the encouragement of the American Consul at London, Francis B. Ogden, made a trip up the Thames at the rate of ten miles an hour in a propeller steamboat of his construction. Many distinguished British naval experts accompanied him on the trip, but, although the *Francis B. Ogden*—the name of the boat—fully demonstrated her superiority, the Admiralty declined to consider her. Captain Robert Field Stockton, U. S. N., happened to be in London at the time, and was greatly impressed with the propeller. Combining the ideas he got from Ericsson with some improvements of his own Stockton caused the construction, in 1838, of the first direct-acting steam propeller ever built. This machinery was placed in the *Robert Field Stockton*, which crossed the Atlantic in 1839 and was used as a tugboat.

Realising the vast advantages of the propeller over the side-wheel war-ship, Stockton persisted in urging the construction of a fleet of this style of war-craft, with the result that, in 1842, the *Princeton*—named in honour of Stockton's home—was projected, and was the first vessel of this type in our navy. The success of the propeller caused

the gradual retirement of the paddle-wheel cruiser, and by 1860 a fleet of screw war-ships had been constructed. The leading vessels of this fleet were the *Niagara*, *Colorado*, *Merrimac*, *Wabash*, *Minnesota*, *Roanoke*, *Brooklyn*, *Lancaster*, *Hartford*, *Richmond*, *Pensacola*, *Pawnee*, *Mohican*, *Narragansett*, *Iroquois*, *Wyoming*, and *Seminole*. These vessels in 1860 were without superiors, in their classes, in the world, and their magnificent achievements in the Civil War fully justified the extravagant praise bestowed upon them at the time of their construction.

But splendid as this third fleet was, it was suddenly proved to be worthless, when, on March 8, 1862, the Confederate *Merrimac* made such short and sanguinary work of our wooden ships in Hampton Roads. The ironclad *Merrimac* caused the creation of the fourth American fleet of war-ships in the nineteenth century, namely, the monitors. Then began the race between the ironclad monsters of the Confederate type and those of the *Monitor*, or Northern style. And here again we have the frank acknowledgment of English writers regarding America's claim to having introduced iron plating in modern war-ships. A distinguished British naval authority says:

> The French were the first to apply in practical shape the idea (which appears to have originated in the United States) of reviving the use of armour, and placing it on the sides of ships. They constructed five floating batteries clad with 4⅝ inches of iron, on an oak backing 8 inches thick. Of these the first was the *Tonnante* [*Tonnerre*], mounting sixteen guns. She was launched at Brest in March, 1855.

As early as 1814, Thomas Gregg of Pennsylvania secured a patent for a floating steam battery plated with iron. This undoubtedly gave the root idea, not only for French vessels of the *Tonnerre* class, but for the Confederate ironclads of the *Merrimac*, *Arkansas*, and *Tennessee*

model. Gregg's invention—a model of which, with specifications, may now be seen in the Patent Office at Washington—was a most ingenious affair, and, had the War of 1812 lasted a year longer, it surely would have revolutionised naval architecture in 1815 as it did some fifty years later. It was provided with a submarine gun. The hull was a trifle short of two hundred feet long, with fifty feet beam, and the bulwarks were protected with patent "spring bayonets and cutlasses, which were slashed about by machinery in a most ferocious manner, with a view to discouraging attempts to board. The wildest stories were circulated in Europe about this wonderful new "steam monster." In a treatise on steam war-craft, published in Scotland soon afterward, the writer said:

> Her length is 300 feet, breadth 200; thickness over her sides 13 feet of alternate oak plank and corkwood; carries 44 guns, four of which are 100-pounders; can discharge 100 gallons of boiling water in a few minutes, and, by mechanism, brandishes 300 cutlasses with the utmost regularity over her gunwales; works also an equal number of pikes of great length, darting them from her sides with prodigious force, and withdrawing them every quarter of a minute.

Truly this "porcupine" of a war-craft was a marvel in her day. She made several trial trips with fairly good success, and her armour plates justify the claim that American constructors were the first to introduce them in the nineteenth century.

The achievements of the *Merrimac* in Hampton Roads demonstrated clearly enough that wooden war-ships were doomed, while the *Monitor's* victory over the Confederate *goliath* proved that the turret style of war-craft was superior to that of the floating battery. Then began the building of our fourth distinct fleet of war-ships, the monitor fleet, and by 1866 the United States—with her ironclads captured from the South—possessed the most

formidable array of iron-mailed ships in the world. The appearance of the *Miantonomoh* in English waters and the trip of the *Monadnock* round Cape Horn fully demonstrated the ability of these new "monsters" to make long and perilous ocean voyages. The close of the Civil War delayed the development of the monitor fleet, so far as the United States was concerned, but improved methods in steel manufacture quickly showed that iron, in naval construction, was no match for steel. Between 1883 and the close of the nineteenth century the United States built its fifth fleet—the present new navy.

In this last fleet, also, we have the acknowledgment of the British that America "gave the cue to naval designers all over the world." An English naval expert, writing of the *Goliath* in 1898 as being the latest and most powerful battle-ship ever constructed in Great Britain, says:

> It is of historic interest that the modern ironclad, with its turrets and massive plates, had its root idea in the famous monitors first designed for the United States Government by Ericsson, who sought to combine invulnerability with very heavy ordnance. . . Ericsson gave the cue to naval designers all over the world, and his elementary principle has only been developed and modified during the years that have elapsed.

In fact, the modern battle-ship bears a striking resemblance to the monitors. Take the vital fighting portions of the *Oregon*, for instance. There we have the armour belt extending only a few feet above the water-line, corresponding to the low freeboard of the monitors. Over this we have the protective deck, not much higher above sea level than the armoured deck of the monitors. Then we have the turrets for the 13-inch guns, supplemented with auxiliary turrets for 8-inch guns, each of these turrets being identical, in elementary principle, with Ericsson's designs. This is the essential fighting portion of

the *Oregon* to-day. Built above and around this, we have an elaborate superstructure, intended primarily for the comfort and convenience of the officers and men, having little or no connection with the main fighting capacity of the ship. This superstructure could be shot through and through without materially disabling the main defensive and offensive capacity of the *Oregon*.

Such, in brief, has been the evolution of the United States Navy in the nineteenth century, and, in fact, that of every maritime Power. Yet our steel fleet may be at the beginning of another revolution. The application of electricity to naval science has merely begun. Submarine warfare is also receiving attention and development. One hundred and twenty-three years ago David Bushnell constructed a submarine boat which, had it been built with all the scientific and mechanical improvements of to-day, might have revolutionised naval warfare before the close of the eighteenth century. American inventors were employed by the French Government as early as 1815 to perfect a system of submarine navigation, and succeeded to a remarkable degree. In the Civil War the Confederates constructed submarine boats which, with better mechanical skill and appliances, would have proved formidable adversaries for our best ironclads. The French, to-day, have created a fleet of submarine boats for which much is confidently promised. The performances of the Holland boat in our own waters have led our Government to contract for a squadron of these new craft.

At the outbreak of the Civil War, Ericsson sent a model of his *Monitor* to Washington in the care of Mr. C. S. Bushnell of New Haven, Conn. The Naval War Board then consisted of Captains Joseph Smith and Hiram Paulding and Commander Charles Henry Davis.

I succeeded at length [said Mr. Bushnell] in getting Captains Smith and Paulding to promise to sign a report advising

the building of one trial battery, provided Captain Davis would join with them. On going to him, I was informed that I might "take the little thing home and worship it, as it would not be idolatry, because it was not in the likeness of anything that is in heaven above, or that is in the earth beneath, or that is in the water under the earth."

Who is there among us to-day bold enough to predict that the war-ship in 1925 will be in the likeness of anything now known as a belligerent craft?

CHANGES IN MILITARY SCIENCE

By C. De W. Willcox

FROM a military point of view, the nineteenth century divides itself naturally into certain well-marked periods. We have first the great era of the Napoleonic wars, closed by the battle of Waterloo. This is followed by long years of peace, broken at last by the Crimean War. The next period to come under notice is that of our own Civil War, in which, in reality, modern conditions of warfare may be said to have taken their rise. The use of independent cavalry, the proper organisation of field artillery, the intrenched battle-field, the influence of railways, to say nothing of other particulars now regarded as essential by all military nations, find their first formal expression, if not always their full development, in this great struggle. Recrossing the Atlantic, the next term in the military situation of the century is found in the rise of Prussia, through the defeat of Austria in 1866, as a Power of the first rank, a position confirmed four years later by its complete overthrow of France. Since that epoch, military development, where fostered, has consisted almost wholly in an imitation, more or less close, of the German system of organisation. These last thirty years are marked, moreover, by a hitherto unparalleled application of the arts and sciences to the improvement of the material of war.

It is clear, then, that the growth of the military art during the nineteenth century has in no wise been a direct function of the time. In some of its most notable aspects

the art has developed more rapidly during the past forty years than it had in the preceding hundred. So conspicuously is this true that we may not assert that its state at the opening of the century was even a transition state. In all countries, with the exception of France, the conditions of the eighteenth had overflowed almost unchanged into the nineteenth century. The era was that of the Great Frederick. His example still bore undisputed sway to such a degree, indeed, that the husk was mistaken for the kernel, the appearance substituted for the reality. The armies of the day were in all essentials hired armies, the soldiers mercenaries, in the sense that war was largely a trade. Organisation, recruiting, mobilisation, administration, supply, transportation — all these, the life-blood of a modern army, were, if not unknown, at least not understood as they are to-day. They had not as yet been generalised into a continuing system applicable to a state either of peace or of war.

Similarly of arms and of equipment: the flint-lock musket, found in the hands of the troops of all armies, had been for many years substantially a constant quantity, while gunpowder, the only explosive and propelling agent employed, had an unbroken ancestry of centuries of continuous use. The great objective in the training of men, France again possibly excepted, lay in the development of a machine-like precision of drill, and this rigidity was carried so far as to convert manœuvring, even under fire, into a sort of geometrical exercise. On the field, deep columns and serried ranks were the rule. Infantry opened fire at two hundred yards with uncertain, if not innocuous, results at superior ranges. Naturally, under these conditions, cavalry could and did intervene directly in the decision of affairs on the battlefield. The range of field artillery was limited, and until Napoleon's appearance its powers and possibilities, were not, on the whole well understood.

The picture changes when we turn to the end of the century. The army is now the " nation in arms "—that is, war is no longer a trade, but a duty, and preparation for war a personal obligation to the state. Upon a declaration of hostilities, the effort is made to bring the full strength of the nation to bear, or, in other words, mobilisation takes place. But this implies a full degree of preparedness, and preparedness, in its turn, a thorough study and application of the principles of organisation and training, of supply and administration. Here we touch upon a well-defined characteristic of final as contrasted with initial conditions; preparation for war goes on unceasingly, in times of the profoundest peace, although no possible cause for war can be discerned in any direction. On the material side, the transformation is equally complete. All the possible resources of modern science have been levied on to contribute their share not only toward the improvement of weapons and of war material in general, but toward supplying the means of placing and maintaining an army in the field. Where one hundred years ago but one explosive was known, modern chemical science has supplied hundreds, and the end is not yet. Whereas, in the days of our grandfathers, any respectable foundry could turn out serviceable guns, to-day the gun is the finest product of metallurgical science, and its construction necessarily limited to specialists. Instead of the flintlock, harmless beyond two hundred yards, we have the magazine rifle, sighted up to eighteen hundred yards, and deadly two miles and more away. The muzzle-loading field-piece of limited range and accuracy has given way to the rapid-fire, breech-loading field gun, delivering from ten to fifteen aimed rounds of shrapnel a minute upon a target so distant as to be practically invisible to the naked eye, with an accuracy so great in trained hands that exposure is suicide. Under these conditions the masses of elder days have dissolved

into thin lines of invisible skirmishers, and cavalry has all but disappeared from the field of actual conflict. In general, armies have increased vastly in size, and the important battles of the future will probably last for days.

To trace the changes here briefly indicated is to trace the progress of the art of war during the century.

In war, as in everything else, the secret of success lies in organisation and preparation. It is interesting, then, to note how two separate and apparently independent conditions have been combined in the evolution of the modern army. The first of these in time, and, with reference to actual combat, in importance, is the creation of the army corps by Napoleon in 1805. What a long step forward this was may be inferred from the fact that Frederick the Great's army was not formed into even brigades and divisions. Besides assuring unity of command, the creation of this strategic unit has led in modern times to the full recognition and definition of the " tactics of the three arms." All modern armies, therefore, whether they belong to military or to unmilitary nations, on taking the field are formed into corps, and these corps are maintained as organic units in times of peace by the great military nations of the world for administrative as well as for purely military reasons.

Hardly less important as leading to a principle of organisation was the limitation imposed by Napoleon after Jena upon the size of the Prussian army. This was never to exceed forty-two thousand men, and, in fact, it never did; that is, at no time while the limitation was in force did Prussia keep more than that number of men under arms. But, thanks to Von Scharnhorst's foresight and intelligence, the members of this army were continually changing. As fast as trained, they were liberated to make room for new and untrained men. With the immediate results of this idea we are not here concerned: what we wish to bring out clearly is that this plan of

organisation, originally local in both time and circumstances, is to-day fundamental in the formation of the armies of all military states. Indeed, these, if the paradox be permissible, may be said not to have a regular army at all. England has one, as have the United States, but in all other important nations the condition of universal military service has made the distinction superfluous, if not meaningless, by wiping out one of its terms. Hence, with the exceptions noted, a mould exists so to say, a form, through which all citizens capable of bearing arms have to pass. From this comes the dictum, "The army is to-day the nation in arms," as distinguished from the purely professional army of the earlier part of the century. The application of the principle of universal service has resulted naturally in a classification of the male population with respect to service. Thus we find in Germany the active army made up of the men with the colours, the reserve of the active army, the *Landwehr*, and the *Landsturm*. Classes more or less similar exist in other countries under different names, the underlying principle being, however, substantially the same in all. This principle further leads directly to the distinction between peace footing and war footing, passage from the one to the other being effected by mobilisation, an operation unknown at the opening of the century. Since, moreover, the whole nation is the army, it results that the modern army has greatly increased in size, a result that would prove embarrassing but for the existence of the staff. It is clear that the formation, instruction, training, supply, and administration of this army form a task of the greatest magnitude. Furthermore, when once formed, if it be not intelligently led and accurately directed upon its objective, it runs the risk, from its mere size, of degenerating into an armed mob. Hence the conditions leading to the formation of the modern army have led, *pari passu*, to the formation of

the modern staff. This simply means that by a natural evolution the functions of the staff have expanded until they now include duties not formerly contemplated. Thus the conception of a general staff, whose special business it is during times of peace to study and prepare for any campaign whatever on any theatre of war whatever, is distinctively modern. The existence of such an organisation is evidently a necessity due partly at least to the great size of modern armies. This very condition, by increasing the difficulties involved, has suggested the only cure of these difficulties — a body of specialists trained to weigh them in peace and to remove them in war. And so of the administrative staff under the same conditions: the supply of an army, taking that term in its most comprehensive sense, is reduced to a continuously operating system. Obviously this particular question could not be left to look to chance for its answer.

The limits of this paper forbid more than a mere mention of the influence of the railway and of the telegraph. Without these, rapid concentration and regular supply would be impossible, a matter of capital importance in view of the great numbers enrolled. It would be hazardous to assert that the railway has been a prime factor in determining these numbers, but there can be no doubt that it has wielded a great influence in this direction. Other things being equal, it is logical and proper to have a large army, because the means of transporting and of supplying a large army are at hand. We are speaking here of railways in a strategic sense.

The art of war is usually defined to consist of two elements, strategy and tactics. Of these, the former is essentially immutable, its principles, few and simple, having remained unchanged throughout the whole course of history. The only recent development in strategy is one, therefore, affecting not its principles, but the means of applying those principles. The employment of the

railway and of the telegraph has greatly increased the rapidity with which strategic combinations may now be carried out, and has added to the number possible within a given time and area. In general, then, strategy is not a measure of the changes occurring between any two given epochs, while tactics, on the contrary, responding sooner or later, if not instantaneously, to any new influence, does furnish such a measure. We shall here briefly consider the tactics of infantry from this point of view, because this arm is still the "queen of battles," and the others have to conform to its possibilities.

To clear the way, let us recollect that the tactics of infantry had remained substantially unchanged from the days of Gustavus Adolphus to those of Frederick the Great; that the latter, by the use of lines in place of columns as an habitual formation, had increased the mobility, and, by the substitution of an iron for a wooden ramrod, the rate of fire, of his troops. As, however, the range of the musket was extremely limited, fire was opened at very short distance, and, independently of any system of tactics, the bayonet was, therefore, a weapon of great importance. Indeed, it might happen on a rainy day that the bayonet was the only weapon available. As was but natural, Frederick's system, known as the "linear" system of tactics, was copied by all other armies.

With the French Revolution came a change. Unquestionably inspired by our own Revolution, in which, for the first time, skirmishers appeared on the field of battle, the French, abandoning the precise linear system, substituted therefor small columns for manœuvre and assault, and deployed lines for firing. In manœuvring, skirmishers covered the front, unmasking it as each company arrived on the firing-line. We note at once that this employment of skirmishers is not the modern use, but, nevertheless, it marks the breaking of tradition.

The French system, known as the perpendicular, was followed in all Napoleon's earlier campaigns. In 1805, he prescribed that the normal formation of the division should be by " linked brigades," a disposition carrying with it the advantage of giving each brigade a separate objective. This principle is to-day fundamental in combat-tactics, even the company having its designated objective.

Frederick's system, decisively beaten at Austerlitz, was finally overthrown at Jena-Auerstädt, and, in 1813, the tactics of the French, including the use of skirmishers, became universal. But before this the English had adopted a two-rank formation, and had successfully opposed thin lines to the heavy columns which the French, for reasons into which we need not here enter, had apparently found themselves compelled to readopt in the Peninsula. In fact, the type-formation was not as yet firmly fixed, the English using heavy columns at New Orleans, and the French, in spite of their experience in Champagne, resuming them with disastrous results at Waterloo.

All the changes here touched upon, it will be noticed, are independent of any change or improvement in weapons, and are simply efforts in the direction of increased mobility and flexibility. Passing by the Crimean War, in which, apparently, the experience of the past has been totally forgotten by both sides, we reach our own Civil War, " remarkable as a turning-point of tactics, there being scarcely a feature of the tactics of the present day that did not have its germ, its prototype, or its development in that great contest." Both armies were now armed with the rifle, the extreme range being one thousand yards, and in the Union army the breech-loader made its appearance before the end of the war. Marksmanship was of a high order on both sides, and infantry fire consequently so deadly as to effect marked changes in tactical formations. These are, briefly, attacks by rushes, attacks

in successive deployed lines, the use of heavy lines of skirmishers in place of the old line of battle, and the use of hasty intrenchments. They were brought about by the common sense of the American soldier, who, unhampered by tradition, knew how boldly to adapt his tactics to the confronting situation. The only further comment necessary is that these changes now constitute the normal order in all civilised warfare.

Europe, however, was slow in learning the lessons of our war. In 1866, the Prussians, using the breech-loader against the Austrian muzzle-loader, generally attacked in company columns, preceded by skirmishers, who were ordered to feel and develop the enemy, and not, as at present, to begin and carry on the combat from beginning to end. But the Prussian privates instinctively left their columns to join the skirmishers, with the result familiar to all. Strange as it may seem, the Prussian authorities failed to appreciate the new conditions of warfare, for, deprecating " the disorder and tumult of the impromptu attack-formation which had sprung into being under the Austrian fire, . . . they waited for the appalling losses of a greater war to emphasise the necessity of a change in their prescribed tactical methods." This experience came in 1870. Both combatants were now armed with the breech-loading rifle, the Chassepot being effective at thirteen hundred yards. Before the end of the war, under the superior musketry fire of the French, the Germans found themselves compelled to deploy their columns, the direct attack being made, and the hostile position invariably carried, by the rushes of swarms of skirmishers. All the nations of Europe now hastened to bring their tactical systems into agreement with the experiences of the Franco-Prussian war. But it took still another war to drive home the conclusions reached by us in 1861–65. The Turks, in 1877–78, armed with the Peabody-Martini rifle, a weapon vastly superior to any

heretofore used, by their use of the American system of hasty intrenchments compelled the Russians finally to deliver their assaults in successive lines of deployed battalions.

This very brief outline shows us that the revolution wrought in infantry tactics during the last half-century has been due almost wholly to the improvements in the rifle. The most recent of these, namely, the introduction of rapid fire through the use of a magazine, will simply carry on the development along the lines already laid down, while the advent of smokeless powder has increased the powers of the defence. All the conditions of the modern combat, therefore, combine to make the frontal attack the exception, flank attack the rule, a principle which is characteristic of modern tactical methods.

But progress has been marked in other directions as well. We may remark the importance of "combined tactics," or "tactics of the three arms." This, of course, is not a new idea; it has simply received fuller expression through a more stringent application of the principle of division of labour, growing out of the universal recognition of the corps as a strategic unit. As this is really a complete army in itself, though on a small scale, so its full effect can be felt only in case all the arms composing it act in concert to secure the common end. Hence, the powers of the three arms are, perhaps, more accurately measured, their relations to one another better adjusted. The new rôle of cavalry, too, deserves notice. If it has lost its former weight on the actual battle-field through the power of both infantry and artillery fire, it has gained in consequence of its employment in independent masses. Operating far in advance of the army, it is the purpose of these masses to cover its concentration and to screen its movements, while seeking at the same time to prevent the formation of the hostile forces, and in any case to discover their emplacements, numbers, and objective.

In other ways, too, it has gained. The dismounted fire-action of this arm — that is, its action on foot as in infantry — is now recognised, the alternative being helplessness on the tactical defensive. So highly have we developed this mode of using cavalry in our own country, that many foreign writers have asserted that our cavalry is only mounted infantry. Our answer is that all European mounted troops are either reluctantly or unconsciously conforming to the type of the American cavalryman of 1864–65, without abating one jot or tittle of their right to be, and to be called, cavalry. In England chiefly, a solution has been sought in the creation of mounted infantry. The idea here is that the horse shall serve purely as a means of rapid transportation, his rider dismounting on reaching the scene of action. No better example can be found than that furnished by the British themselves in South Africa, in their attempts to cope with the mobility of the Boers. The reader will recognise at once in the mounted infantry a reversion to the original type of dragoon.

We may fitly conclude this part of the discussion by drawing attention to the increased responsibilities devolved by modern conditions of warfare on the private in the ranks. He has ceased to be considered a machine, mere food for powder, a molecule of the mass whose shock is to crush the adversary. On the contrary, as many occasions will surely arise calling for the exercise of sound judgment, so is he expected to be an intelligent element of the national defence, his value to his country bearing a direct ratio to the degree to which his intelligence can be awakened and trained.

No survey of the military century would be adequate without some reference to the immense development given by the mechanical spirit of the age to the enginery of war. Of course, the impulse in question is not purely military; it is simply the application to war of a principle

pervading every other phase of life. In general, every invention that might possibly increase the economy, certainty, or rapidity of a displacement, whether of men, of material, or of projectiles, has been summoned to give its share of improvement. All inventions bearing on the transmission or acquisition of intelligence have been pressed into service. One of the latter—the balloon—antedates the century, but the idea of photographing the enemy's position from its car is new. So is the application of wireless telegraphy to purposes of communication in the field; this invention is turned to a military end almost before it has definitely left the inventor's hands.

The greatest advance, however, has been in the perfection of man-killing machinery. Upon this one subject have been expended all the resources of modern metallurgical and chemical skill until the projectile weapon of the day, whether gun or small-arm, is a marvel of strength, accuracy, and convenience. From the rude tube of our forefathers we have passed to engines of complicated structure, deadly beyond the limits of unaided vision, and of a rapidity of fire undreamed of even thirty years ago. So great is the volume of fire, so destructive the shrapnel, that in field artillery duels the question of success is reduced to that of first getting the range. Each class of guns must now have its special propelling agent, and a serious effort is making to discover some means of launching in safety the frightfully destructive explosives due to modern chemical research.

Side by side with this sort of development has marched that of the art of protection. But here, in contrast with the increasing complexity of the means of offence, we remark the increasing simplicity of the means of defence. At the dawn of the century, the genius of Vauban still prescribed the bastion system for any and all sites to be fortified. Just as in the field, rigid and pedantic notions governed all troop-evolutions, so in fortification the pre-

vailing idea in each case was to furnish a rigid geometrical solution. To-day the idea is first of all to adapt the work to the site, independently of the type. Steel turrets, cupolas, armoured casements, are provided for specially exposed points—a solution made possible by the great general advance in metallurgy. Concrete has displaced masonry, and the face presented to the enemy is always either of earth or, where that is impossible, of steel.

Upon the general question of fortifications, authorities are divided into two camps. Their advocates assert that fortresses cover a mobilisation, retard the enemy, allow a defeated army to refit under shelter. Their opponents, on the other hand, maintain that they tie down an army, reduce the numbers of the field armies; that forts will be covered and not reduced; that they will not keep out a superior, and are useless against an inferior enemy; and that a government cannot afford to man them, if the antagonists are otherwise evenly matched. The question will probably always remain open. In the meantime, the frontiers of Europe bristle with forts, and every important capital is the centre of a vast intrenched camp. The great contribution of the century to the question of fortification is not so much one relating to the type, though this is marked, as one relating to the occasion. From hasty or improvised intrenchments these latter days have seen the evolution to such defences as those of Petersburg and of Plevna, erected not with the deliberation of peace, but under the stress of war, to meet its exigencies as they arise.

The conditions now laid down mark the character of modern warfare. As the whole energy of a nation—a constant quantity in each case—is sought to be put forth in the shortest possible time, so the period during which this energy is expended is reduced. We may therefore confidently expect that wars between civilised nations, when carried on by the regularly organised forces, will be

short. Naturally no limits can be assigned, for these will vary in each particular case, not only with the military factors involved, but also with others, such as the character of the people and the policy of the combatants, to which no arbitrary value can be assigned. We may feel reasonably sure, however, that the great and increasing complexity of modern life, involving international contacts at an ever-increasing number of points, will combine with the military conditions hereinbefore outlined to reduce the duration of war to the utmost. Whether it will put a stop to war, no one can tell. But it should not be forgotten that this very complexity, in these days of "expansion," may itself prove a fruitful source of conflict. In other words, wars of dynasty, wars to maintain the balance of power, are obsolete; should an armed struggle break out in the future, it will probably owe its origin, as it will certainly owe its strength, to the people.

THE END.

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